FLORENCE COPPER

FLORENCE COPPER INC.
1575 W. Hunt Highway, Florence, Arizona 85132 USA
florencecopper.com

January 28, 2022

Arizona Department of Environmental Quality
Water Quality Compliance Section
Mail Code 5415B-1
1110 West Washington Street
Phoenix, Arizona 85007

Attention: Tracy Bunch

Subject: 2021 Annual Report
Aquifer Protection Permit No. P-101704, LTF 88973

Dear Mr. Bunch:

Florence Copper Inc. (Florence Copper) is submitting this report in accordance with Section 2.7.4.1 of Aquifer Protection Permit (APP) No. P-101704, LTF 88973, dated April 30, 2021, for the Florence Copper Project.

Background Information

The Florence Copper Project is an in-situ copper extraction facility subject to two related permits issued by the Arizona Department of Environmental Quality (ADEQ) and the U.S. Environmental Protection Agency (USEPA).

APP Covering the 1997-98 BHP Pilot Facilities and Future Operations (APP):

- ADEQ APP No. P-101704 (LTF 76820) Significant Amendment dated December 8, 2020 and Other Amendment LTF 88973 dated April 30, 2021.

The authorized facilities and monitoring wells are identified on Figure 1, and the configuration of the Production Test Facility (PTF) wellfield, which was incorporated into the amended December 8, 2020 permit, is shown on Figure 2.

Prior to the amended permit issued on December 8, 2020, the Florence Copper Project was regulated under APP No. P-101704, LTF 65804 dated October 13, 2017.

In 1997, the BHP test wellfield, a small leachate processing facility, and a double-lined evaporation pond were constructed as authorized by APP No. P-101704 in 1997. The Pilot Test Facility operated from October 31, 1997 to February 9, 1998. The test area was rinsed until September 1, 2004. Cessation of hydraulic control for testing was approved by both agencies and the wellfield has since remained inactive. Subsequently, no Sitewide permit related activities took place until the issuance of the amended permit on December 8, 2020.

Underground Injection Control (UIC) Permit Covering the Current PTF:

- USEPA UIC Permit No. R9UIC-AZ3-FY11-1 dated December 20, 2016.

This permit authorizes operation of the PTF and sets forth separate monitoring requirements to be applied at the PTF, which lies within the area covered by the APP. The UIC facilities and monitoring wells are identified on Figure 1. The facility received authorization to proceed with pre-operational activities on July 13, 2017. The PTF wellfield was completed and began operations on December 15, 2018. The rinsing activities for the PTF began on June 26, 2020. Solutions from the wellfield continued to be processed through the Solvent Extraction/Electrowinning (SX/EW) plant to produce copper in the fourth quarter (Q4) of 2020 until October 29, 2020. Wellfield rinsing activities have continued through Q4 2021 and will continue in 2022.

This report documents annual reporting requirements required by APP No. P-101704, LTF 88973 during 2021. Reporting for the APP and UIC permit is performed separately; however, some information pertains to multiple permits and is reported accordingly.

Section 2.7.4.1 Annual Report

Section 2.7.4.1 of the APP requires an annual report shall be submitted no later than 30 days following the end of the calendar year presenting updates to the groundwater model and the results of any liner assessments triggered by permit contingency requirements. Specifically, the annual report shall include a Groundwater Flow Model Evaluation and Update Report and a Liner Leakage Assessment Report (if applicable).

Section 2.7.4.1.1 Groundwater Flow Model Evaluation and Update Report

The Groundwater Flow Model Evaluation and Update Report, in accordance with Section 2.7.4.1.1 of the APP, shall assess the performance of operating resource blocks, rinsing of resource blocks, and any changes to the post-closure period based on updated groundwater flow modeling results.

The site groundwater flow model was revised in June 2021 with updated pumping rates and new irrigation wells; these results are presented in the Groundwater Flow Model Evaluation and Update Report included in Attachment 1.

Section 2.7.4.1.2 Liner Assessment Report

The Liner Assessment Report, in accordance with Section 2.7.4.1.2 of the APP, requires a liner assessment report to be submitted if an Alert Level (AL) #1 has been exceeded per Section 2.6.2.2 (Normal Leakage) and/or 2.6.2.3 (Liner Failure or Rips) of the APP. Specifically, the Liner Assessment Report shall also include:

- The number and location of holes identified; and
- A table summarizing AL exceedances including the frequency and quantity of fluid removed, and corrective actions taken.

The BHP Copper evaporation pond (BHP Pond) was placed into service on July 7, 2021. On August 17 an exceedance occurred for AL #1 normal liner leakage at the BHP Pond leak collection and removal system, and the incident was reported via MyDEQ. Flow to the BHP Pond was discontinued and a leak detection survey was conducted. Liner repairs were completed at four areas below the water level. Additional surveys and repairs on the liner above the water level were completed in September. ADEQ issued a "resolved" status for the incident on September 27, 2021. Leak collection and removal system monitoring after completion of the liner repairs has been below the normal liner leakage AL.

Details related to the normal liner leakage of the BHP Pond are provided in the Liner Assessment Report included in Attachment 2.

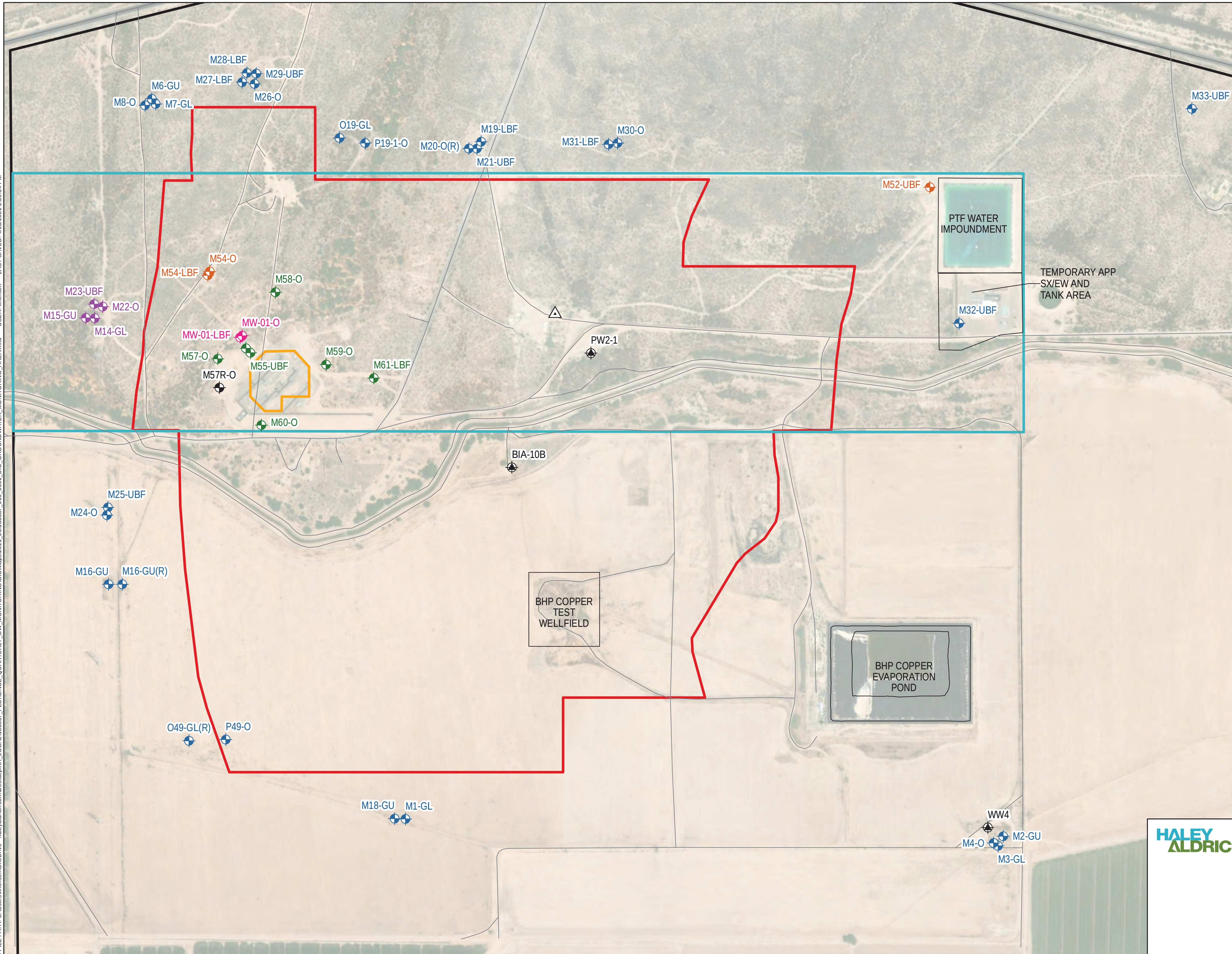
The contents of this report are believed to be accurate and complete based upon the data submitted to me and reviewed by me. Please call (520) 316-3710 should you have any questions concerning this report.

Sincerely,
Florence Copper Inc.

Brent Berg
General Manager

Enclosures:
- Figure 1 – Groundwater Monitoring Area
- Figure 2 – PTF Wellfield
- Attachment 1 – Groundwater Flow Model Evaluation and Update Report
- Attachment 2 – Liner Assessment Report

FIGURES



LEGEND

- PRODUCTION WELL
- REPLACEMENT SUPPLEMENTAL MONITORING WELL
- APP AND UIC POC
- APP MONITORING
- UIC OPERATIONAL MONITORING WELL
- UIC POC WELL
- UIC SUPPLEMENTAL MONITORING
- SHAFT
- ISCR WELLFIELD
- PRODUCTION TEST FACILITY (PTF) WELLFIELD
- STATE MINERAL LEASE BOUNDARY
- FLORENCE COPPER PROPERTY BOUNDARY

NOTES

1. APP PERMIT NO. 101704, LTF 88102
2. UIC PERMIT NO. RQUIC-A23-FY11-1
3. M16-GU AND M20-O HAVE BEEN REPLACED. WELLS ARE INACTIVE AND NO MONITORING IS PERFORMED. WELLS HAVE NOT YET BEEN ABANDONDED.
4. AERIAL IMAGERY SOURCE: ESRI

N

0 500 1,000

SCALE IN FEET

HALEY ALDRICH

FLORENCE COPPER, INC.
FLORENCE, ARIZONA 85132

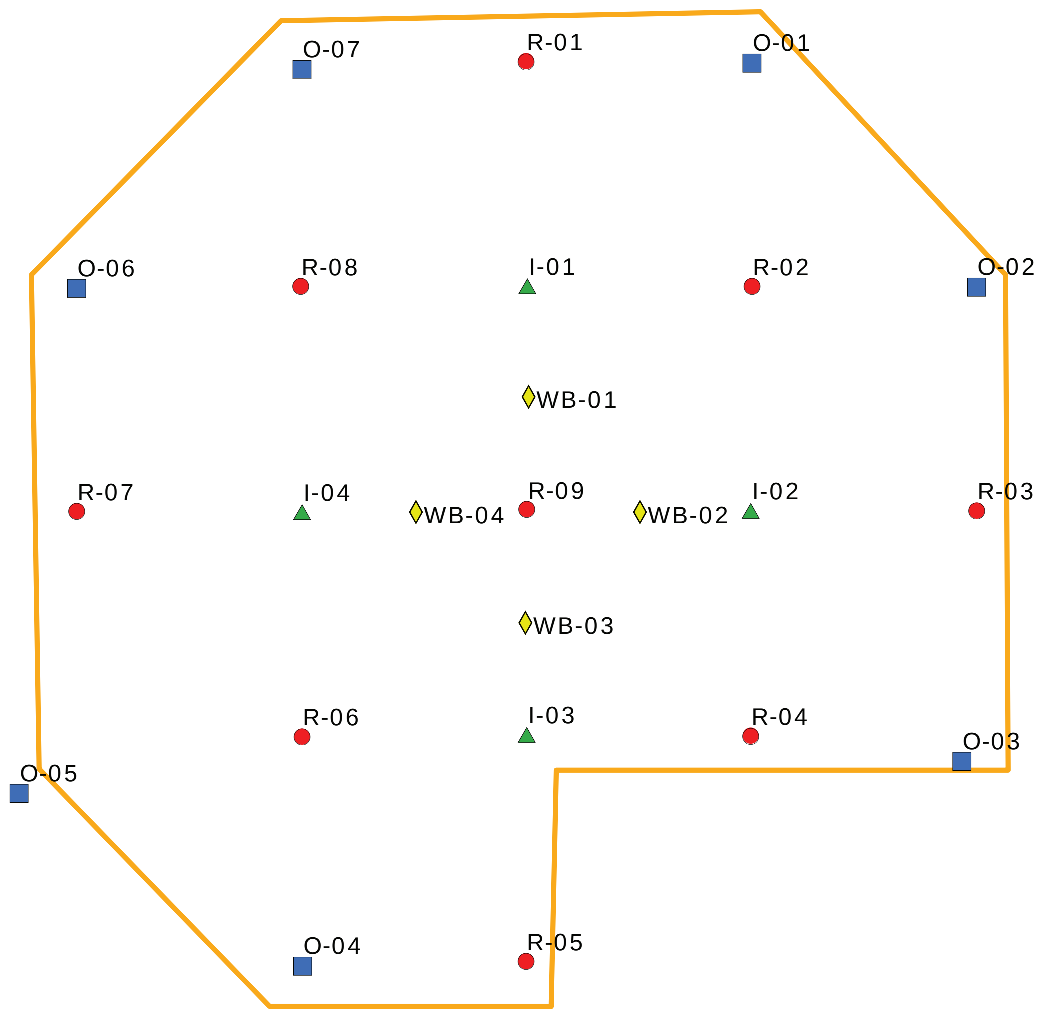
GROUNDWATER MONITORING AREA

OCTOBER 2021

FIGURE 1

GIS FILE PATH: C:\Users\khensen\OneDrive - haleyaldrich.com\Desktop\KH_LOCAL\133887_FLORENCE_QUARTERLY_GW_MONITORING\GIS\Maps\2021_03\133887_010_0001_UIC_GROUNDWATER_MONITORING_AREA.mxd — USER: khensen — LAST SAVED: 4/26/2021 2:39:34 PM

GIS FILE PATH: G:\Projects\Florence Copper\132473 Florence Groundwater Permitting\GIS\Maps\2019_01\PTF WELLFIELD.mxd — USER: cgiusti — LAST SAVED: 1/25/2019 10:17:50 AM



LEGEND

- INJECTION WELL
- OBSERVATION WELL
- RECOVERY WELL
- WESTBAY WELL
- PTF WELLFIELD

NOTES

1. ALL LOCATIONS AND DIMENSIONS APPROXIMATE

N

0 30 60

SCALE IN FEET

HALEY ALDRICH

PRODUCTION TEST FACILITY
FLORENCE COPPER INC.
FLORENCE ARIZONA

PTF WELLFIELD

FLORENCE COPPER

OCTOBER 2021

FIGURE 2

ATTACHMENT 1

Groundwater Flow Model Evaluation and Update Report

HALEY ALDRICH

HALEY & ALDRICH, INC.
One Arizona Center
400 E. Van Buren St., Suite 545
Phoenix, AZ 85004
602.760.2450

TECHNICAL MEMORANDUM

28 January 2022
File No. 204383-000

REGISTERED GEOLOGIST
CERTIFICATE NO.
39869
MARK D.
NICHOLLS
Date Signed 1/28/22
ARIZONA, U.S.A.
Exp. 9/30/24

TO: Florence Copper Inc.
Brent Berg, General Manager

FROM: Haley & Aldrich, Inc.
Mark Nicholls, R.G.
Laura Menken, R.G.

SUBJECT: Groundwater Flow Model Evaluation and Update Reporting Response to Aquifer Protection Permit No. P-101704, Section 2.7.4.1.1.

Aquifer Protection Permit No. P-101704 (APP) was issued to Florence Copper Inc. (Florence Copper) by the Arizona Department of Environmental Quality (ADEQ) on 30 April 2021 and authorizes operation of an in-situ copper extraction facility at the Florence Copper site. The APP requires that Florence Copper evaluate and update the project groundwater flow model and submit an annual report describing the model performance and update.

Specifically, the Groundwater Flow Model Evaluation and Update Report, in accordance with Section 2.7.4.1.1 of the APP, is required to assess the performance of operating resource blocks, rinsing of resource blocks, and any changes to the post-closure period based on updated groundwater flow modeling results. The model update is required to include:

- The incorporation of hydrologic and lithologic data generated from aquifer tests, routine monitoring, and operation of existing in-situ copper recovery (ISCR) wells;
- The inclusion of pumping data from new production wells installed within a 1-mile radius of the wellfield;
- A comparison and incorporation of hydraulic conductivity values generated from one constant rate aquifer test conducted in each new resource block in which wells were installed during the previous year. If necessary, the values will be updated in the model for the affected area and the model will be run to test the model calibration;
- A comparison and incorporation of porosity values determined from neutron porosity logs run in one well in each new resource block in which wells were installed during the previous year. If necessary, the values will be updated in the model for the affected area and the model will be run to test the model calibration; and
- A comparison of observed drawdown to model simulated drawdown.

Each of the required annual report and model update elements are described in order below.

Performance of Operating Resource Blocks

No assessment of performance of operating resource blocks can be performed for the 2021 annual period because no ISCR resource blocks were in production between 1 January and 31 December 2021.

Rinsing Resource Blocks

The Production Test Facility (PTF) ISCR wells have been undergoing rinsing activities throughout the 2021 annual period. The PTF ISCR wellfield is the only group of wells that has undergone ISCR production, and consequently, no additional resource blocks have transitioned to rinsing status during the 2021 annual period.

Changes to the Post-Closure Period Based on the Groundwater Model Update

No changes are proposed to the post-closure period defined in APP No. P-101704 based on the 2021 groundwater model update.

Model Update Elements

DATA GENERATED FROM EXISTING ISCR WELLS

No new hydrologic data or lithologic data were generated from aquifer tests, routine monitoring, or operation of existing ISCR wells during 2021. The PTF wells are the only existing ISCR wells at the Florence Copper site and they have been in continual rinsing status for the 2021 annual period.

NEW WELLS WITHIN ONE MILE OF ISCR WELLFIELD

Two new irrigation wells were installed within 1 mile of the PTF ISCR wellfield. No other new production wells were installed within 1 mile of the ISCR wellfield during the 2021 annual period. The new irrigation wells and planned pumping were incorporated into the groundwater model update included as Exhibit 1.

AQUIFER TESTING IN NEW RESOURCE BLOCKS AND EFFECT ON MODEL CALIBRATION

No new ISCR wells were installed and no new resource blocks activated during the 2021 annual period. Consequently, no aquifer tests were conducted at new ISCR wells or in new resource blocks during the 2021 annual period.

COMPARISON AND INCORPORATION OF NEUTRON LOG POROSITY DATA

No new ISCR wells were drilled and no new neutron logs were run in ISCR wells during the 2021 annual period. Consequently, no new neutron log porosity data were incorporated into the groundwater model update for 2021.

COMPARISON OF OBSERVED DRAWDOWN TO MODEL SIMULATED DRAWDOWN

No new lithologic, hydrologic, or porosity data were generated during 2021, and no new ISCR wells or resource blocks were activated during 2021. Consequently, the model update was limited to the incorporation of two new irrigation wells and an update of the Arizona Department of Water Resources pumping rates for wells within the model domain. These limited changes did not affect the model calibration or the relationship between observed and simulated drawdown for wells outside the ISCR wellfield. No comparison of observed and simulated drawdown could be made within the ISCR wellfield because no ISCR wells or resource blocks were active during the 2021 annual period.

A Technical Memorandum describing the 2021 model update is included as Exhibit 1.

Please contact Mark Nicholls (602-819-0913) with any questions you may have regarding this memo.

Attachments:

Exhibit 1 – Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

EXHIBIT 1

Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

HALEY & ALDRICH, INC.
One Arizona Center
400 E. Van Buren St., Suite 545
Phoenix, AZ 85004
602.760.2450

TECHNICAL MEMORANDUM

29 March 2021
File No. 132473-005

TO: Florence Copper Inc.
Brent Berg, General Manager

FROM: Haley & Aldrich, Inc.
Jacob Chu, Ph.D.
Miao Zhang, P.E.
Mark Nicholls, R.G.

SUBJECT: Irrigation Well Groundwater Model Simulations Provided in Support of Florence Copper's October 2019 Application for UIC Permit

At the request of Florence Copper Inc. (Florence Copper), Haley & Aldrich, Inc. (Haley & Aldrich) conducted model simulations to evaluate the effects of pumping at two new irrigation wells, designated N1 and N2. These wells would be operated during and after the in-situ copper recovery (ISCR) operations that are planned to occur under the above-reference underground injection control (UIC) permit (Permit), in lieu of existing irrigation wells BIA-9 and BIA-10B which would be plugged and abandoned in accordance with the terms of the Permit. The well locations are depicted in Figure 1.

Haley & Aldrich's simulations consisted generally of two parts: (1) evaluation of the possible effects of operating the new irrigation wells on migration of ISCR-injected fluids (ISCR Injection Simulations); and (2) evaluation of the possible effects of operating the new irrigation wells on the discharge impact area for a hypothetical period of 30 years following the conclusion of ISCR operations (Discharge Impact Area Simulation). Each simulation was run as a solute transport simulation using the same groundwater model described in Attachment A of the 4 October 2019 application for the UIC permit (Application). Specifically, the ISCR operations, discharge impact area, and other model inputs and configurations were held the same as described in Attachment A of the Application, including Section A.3.2.2 and Exhibit A-2, with the exception of the two new irrigation wells and update of planned facility makeup water production. The simulations and their results are described below.

Updated Model Used to Conduct the Simulations

The original groundwater flow model was developed as part of a hydrogeologic study conducted in support of the UIC permit and aquifer protection permit (APP) applications. The original model had a calibration period extending from 1984 through 2010 and was used by the U.S. Environmental Protection Agency (USEPA) to assess hypothetical, potential discharge impacts resulting from Florence Copper's ISCR production test facility operations.

As described in Attachment A, Exhibit A-2 of the Application, the original model was updated in 2019 in support of the applications for APP and UIC Permit of Florence Copper's planned ISCR commercial operations. The 2019 model update:

- Extended the model to run from 1984 through 2018;
- Incorporated additional regional pumping well and water level data through 2018 (the most recent data available at the time); and
- Was calibrated against additional observed water level data by adjusting the general head and recharge boundary conditions between 2011 and 2018 to reflect variation of water exchange across the model domain.

Model Inputs and Configurations Employed in the Simulations

Hydraulic Properties

All hydraulic properties and boundary conditions used in the 2019 updated model were kept the same for the ISCR Injection Simulations and the Discharge Impact Area Simulation. The hydraulic properties applied at the location of each of the hypothetical injection wells in the ISCR Injection Simulations are listed in Table 1.

General Head Boundaries

The general head boundary (GHB) head value for each GHB cell was set to be the GHB head value for the last stress period in the 2019 updated model, while the GHB conductance remained the same.

Recharge

The recharge distribution was set to be the same as the recharge distribution for the last stress period in the 2019 updated model.

Initial Heads

The simulated head for the last time step of the 2019 updated model was used as the initial head.

Pumping Wells

The pumping conditions for the last stress period of the 2019 updated model (i.e., year 2018) were used. However, added to these conditions was pumping at the additional wells, depicted in Figure 1, each at its planned capacity with a conservative 100 percent duty cycle. The well names and specified pumping rates are:

- Well N1: 1,030 gallons per minute (gpm)
- Well N2: 1,300 gpm

Wells N1 and N2 were screened in model layers 1 through 5, which is consistent with typical irrigation wells completed in the area.

Note, based on information provided by San Carlos Irrigation Project, the aggregate production capacity of wells BIA-9 and BIA-10B is no more than 2,330 gpm.

Injection Wells

Five injection wells were rendered for the ISCR Injection Simulations. The same five injection wells were considered in the 2019 model runs.

The Sidewinder Fault Injection Well penetrates the fault in model layer 7, just below the exclusion zone in the Bedrock Oxide Unit. The NW Injection Well penetrates the Sidewinder fault in model layer 10, near the base of the Bedrock Oxide Unit. The Bedrock Oxide Unit thins on the eastern edge of the ISCR area and thickens to the west. Where the injection zone thins, the injection rate was reduced below 60 gpm and was set at a value of 0.15 gpm per foot of injection zone. Due to variation in the thickness of the Bedrock Oxide Unit, this adjustment was applied where the injection zone is less than 400 feet thick. Where the injection is thicker than 400 feet, the injection rate was maintained at 60 gpm. The injection zone thickness at the well simulated at the northeastern corner of the ISCR area was approximately 220 feet thick, and consequently, the injection rate at this location was set at 33 gpm. The other four wells were maintained at an injection rate of 60 gpm.

Simulation Period

The simulation periods for the ISCR Injection Simulations were 48 hours and 30 days. The simulation period for the Discharge Impact Area Simulation was 30 years.

Initial Concentrations

In the ISCR Injection Simulations, initial solute concentration was set at 0 milligrams per liter (mg/L) across the entire model domain. In the Discharge Impact Area Simulation, initial solute concentration was set at 0 mg/L across the model domain except for the ISCR wellfield area, which had an initial concentration of 750 mg/L in model layers 7 through 10.

Specified Concentration Boundary

Solute concentrations were set at 10,000 mg/L in the five injection wells in the ISCR Injection Simulations. There is no specified concentration boundary in the Discharge Impact Area Simulation.

Other Transport Parameters and Solver Settings

All other transport parameters and solver settings were kept the same as those used in the 2019 updated model. Longitudinal, transverse, and vertical transverse dispersivity values were 10, 1, and 0.1 feet, respectively. The simulated solute was conservative (with no sorption or reaction).

ISCR Injection Simulations with New Irrigation Wells

Haley & Aldrich used the 2019 updated model to evaluate the potential distance of migration of ISCR injection fluids resulting from ISCR injections at hypothetical injection wells located along the perimeter of the planned ISCR wellfield, with the new irrigation wells pumping. The hypothetical injection wells are the same as those employed in the 2019 model runs. Section A.3.2.2 of the Application explains that the wells' locations were spaced widely apart from one another to allow evaluation of injection zone differences that are reflected in the model construction.

One hypothetical injection well was placed in each corner of the ISCR area and one additional hypothetical injection well was placed in the Sidewinder fault where it crosses the northern boundary of the ISCR wellfield. These wells are identified as NW Injection Well, NE Injection Well, SW Injection Well, SE Injection Well, and Sidewinder Fault Injection Well. The locations of these wells are shown on Figures 2 through 11.

Each of the injection wells was simulated to inject fluids for a period of 48 hours and 30 days, without any extraction pumping or hydraulic control, to evaluate the potential effects of injection under an unrealistic worst-case scenario, as was done for the 2019 model runs.[1]

Figures A-4 through A-13 of the Application depict the results of the 2019 model runs, which were conducted without pumping from the new irrigation wells described in this memo. Those figures are included in Exhibit A-8-1 of this memo.

Figures 2 through 11 of this memo depict the results of the same model runs with the new irrigation wells pumping. The model files for these runs are included in Exhibit A-8-2 of this memo.

[1] Model scenarios simulating injection without hydraulic control for periods of 48 hours and 30 days were developed based on requests by the USEPA; however, they do not represent planned or realistic ISCR operations. There is no circumstance in which Florence Copper would continue to inject raffinate after a loss of hydraulic control pumping. Based on the applicable contingency plans included in the APP and that would be included in the UIC permit, if hydraulic control is lost, Florence Copper would cease injection and not resume injection until hydraulic control had been reestablished. Moreover, the basic purpose of the pilot-scale ISCR operations, which were conducted under the production test facility (PTF) UIC permit, was to demonstrate that hydraulic control can be maintained to prevent excursions of ISCR solutes beyond the limits of the aquifer exemption. That demonstration was made according to the terms of the PTF UIC permit, using ISCR wells that were constructed and operated in the same manner and at the same depths as the wells that would be constructed and operated for the commercial-scale operations.

The model scenarios and results are discussed below.

NW Injection Well 48 Hours (Figure 2 and Application Figure A-4)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 138 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NW Injection Well for a period of 48 hours without extraction or any type of hydraulic control resulted in 125 feet of horizontal migration of injected solution (a difference of 13 feet less migration). The maximum distance of horizontal migration was in model layer 10, where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same .

NW Injection Well 30 Hours (Figure 3 and Application Figure A-5)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NW Injection Well for a period of 30 days without extraction or any type of hydraulic control resulted in 250 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NW Injection Well for a period of 30 days without extraction or any type of hydraulic control resulted in 225 feet of horizontal migration of injected solution (a difference of 25 feet less migration). The maximum distance of horizontal migration was in model layer 10, where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

NE Injection Well 48 Hours (Figure 4 and Application Figure A-6)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NE Injection Well for a period of48 hours without extraction or any type of hydraulic control resulted in 66 feet of horizontal migration of injected solution.

- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NE Injection Well for a period of 48 hours without extraction or any type of hydraulic control resulted in 69 feet of horizontal migration of injected solution (a difference of 3 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 30 feet into model layer 5, which represents the lower portion of the lower basin fill unit (LBFU).
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

NE Injection Well 30 Hours (Figure 5 and Application Figure A-7)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical NE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 126 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical NE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 144 feet of horizontal migration of injected solution (a difference of 18 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness (100 feet at this location) of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SE Injection Well 48 Hours (Figure 6 and Application Figure A-8)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SE Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 131 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SE Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 125 feet of horizontal migration of injected solution (a difference of 6 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6 (exclusion zone) and 40 feet into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SE Injection Well 30 Hours (Figure 7 and Application Figure A-9)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 189 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SE Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 175 feet of horizontal migration of injected solution (a difference of 14 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness (80 feet at this location) of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SW Injection Well 48 Hours (Figure 8 and Application Figure A-10)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 116 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SW Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 125 feet of horizontal migration of injected solution (a difference of 9 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred 40 feet into model layer 6, which represents the exclusion zone.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

SW Injection Well 30 Hours (Figure 9 and Application Figure A-11)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical SW Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 169 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical SW Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 175 feet of horizontal migration of injected solution (a difference of 6 feet more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6, and into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Sidewinder Fault Injection Well 48 Hours (Figure 10 and Application Figure A-12)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical Sidewinder Fault Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 82 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical Sidewinder Fault Injection Well for a period of 48 hours, without extraction or any type of hydraulic control, resulted in 81 feet of horizontal migration of injected solution (a difference of 1 foot more migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit and the location where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layer 6, and into model layer 5, which represents the lower portion of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Sidewinder Fault Injection Well 30 Hours (Figure 11 and Application Figure A-13)

Horizontal Migration

- In the 2019 model simulation (without the new irrigation wells pumping), injection at the hypothetical Sidewinder Fault Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 210 feet of horizontal migration of injected solution.
- In the model simulation with the new irrigation wells pumping, injection at the hypothetical Sidewinder Fault Injection Well for a period of 30 days, without extraction or any type of hydraulic control, resulted in 181 feet of horizontal migration of injected solution (a difference of 29 feet less migration). The maximum distance of horizontal migration was in model layers 7 and 8, which represent the upper Bedrock Oxide Unit and the location where the Sidewinder fault intersects the well.

Vertical Migration

- In the 2019 model simulation (without the new irrigation wells pumping), the upper limit of vertical migration occurred through model layers, 6, 5, and 4, which represent the exclusion zone and the full thickness of the LBFU.
- In the model simulation with the new irrigation wells pumping, the vertical migration was the same.

Figure 12 shows a plan view of the maximum distances of migration under the 48-hour and 30-day injection simulations discussed above.

Discharge Impact Area Simulation with New Irrigation Wells Pumping

Attachment A, Exhibit A-2 of the Application describes the 2019 model simulation of solute transport for a period of 30 years after cessation of ISCR operations (including cessation of hydraulic control). Haley & Aldrich reproduced this model simulation with the addition of the new irrigation wells pumping continuously at the rates stated above.

As in the 2019 model run, the extent of migration is defined by the outer 2 mg/L concentration contours for all of the layers. The faults, which were assigned a hydraulic conductivity ten times higher than the surrounding bedrock, slightly enhance migration during the 30-year period.

The solute transport defined by the 2 mg/L concentration contour with the new irrigation wells pumping is shown on Figure 13. For comparison, the solute transport defined by the 2 mg/L concentration contour without the irrigation wells pumping, as reported in Attachment A, Exhibit A-2 of the Application, is also shown on Figure 13.

Please contact Mark Nicholls (602-819-0913) with any questions you may have regarding this memo.

Attachments:

Table 1 – Groundwater Model Results for Specified Injection Scenarios
Figure 1 – Location of Subject Wells
Figure 2 – Cross Sections NW Injection Well, 48 Hours Injection with no Extraction
Figure 3 – Cross Sections NW Injection Well, 30 Days Injection with no Extraction
Figure 4 – Cross Sections NE Injection Well, 48 Hours Injection with no Extraction
Figure 5 – Cross Sections NE Injection Well, 30 Days Injection with no Extraction
Figure 6 – Cross Sections SE Injection Well, 48 Hours Injection with no Extraction
Figure 7 – Cross Sections SE Injection Well, 30 Days Injection with no Extraction
Figure 8 – Cross Sections SW Injection Well, 48 Hours Injection with no Extraction
Figure 9 – Cross Sections SW Injection Well, 30 Days Injection with no Extraction
Figure 10 – Cross Sections Sidewinder Fault Injection Well, 48 Hours Injection with no Extraction
Figure 11 – Cross Sections Sidewinder Fault Injection Well, 30 Days Injection with no Extraction
Figure 12 – Plan View of Maximum Extent of Migration During 48-Hour and 30-Day Injection Scenarios without Hydraulic Control Pumping
Figure 13 – Discharge Impact Area 30 Years After Closure with New Irrigation Wells Pumping
Exhibit A-8-1 – Figures A-4 through A-13 from the 4 October 2019 UIC Application
Exhibit A-8-2 – Model Files

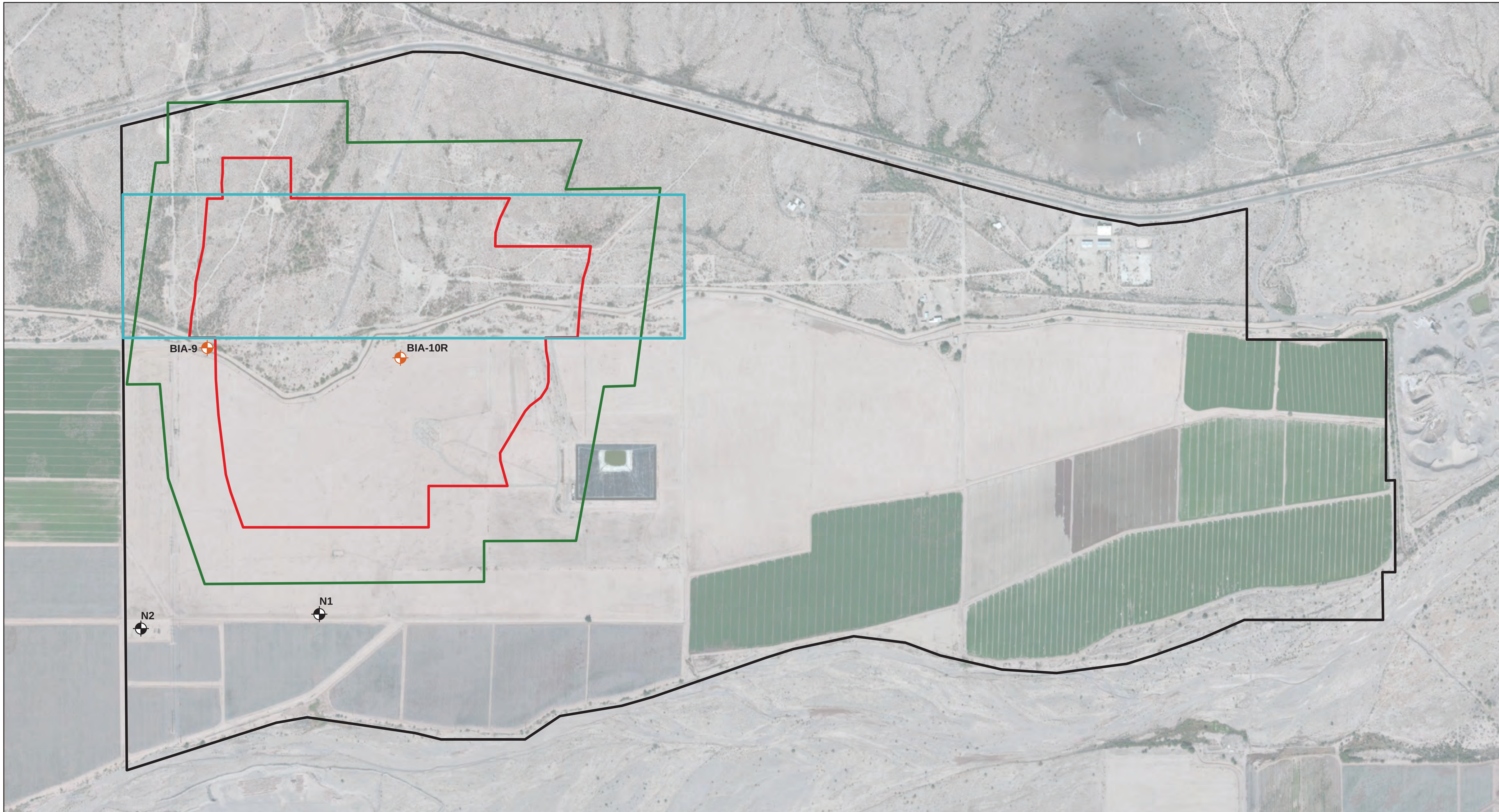
TABLE

TABLE 1
GROUNDWATER MODEL RESULTS
FOR SPECIFIED INJECTION SCENARIOS
FLORENCE COPPER PROJECT
FLORENCE, ARIZONA

	Simulation Period	Injection Rate (gpm)	Porosity of Oxide Layers (%)	Fault Zone Porosity (%)	Fault Zone Hydraulic Conductivity (ft/day)	Maximum Distance of Horizontal Fluid Migration (feet)
NW Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	225
NE Well	48 hours	33	5 - 8	10	6	69
	30 days	33	5 - 8	10	6	144
SW Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	175
SE Well	48 hours	60	5 - 8	10	6	125
	30 days	60	5 - 8	10	6	175
Sidewinder Fault Well	48 hours	60	5 - 8	10	6	81
	30 days	60	5 - 8	10	6	181

Notes:
% = percent
ft/day = feet per day
gpm = gallons per minute

FIGURES



LEGEND

- NEW IRRIGATION WELL
- EXISTING WELL
- STATE MINERAL LEASE BOUNDARY
- AREA OF REVIEW BOUNDARY
- ISCR WELL FIELD
- FLORENCE COPPER PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. AERIAL IMAGERY SOURCE: ESRI

N

0 900 1,800

SCALE IN FEET

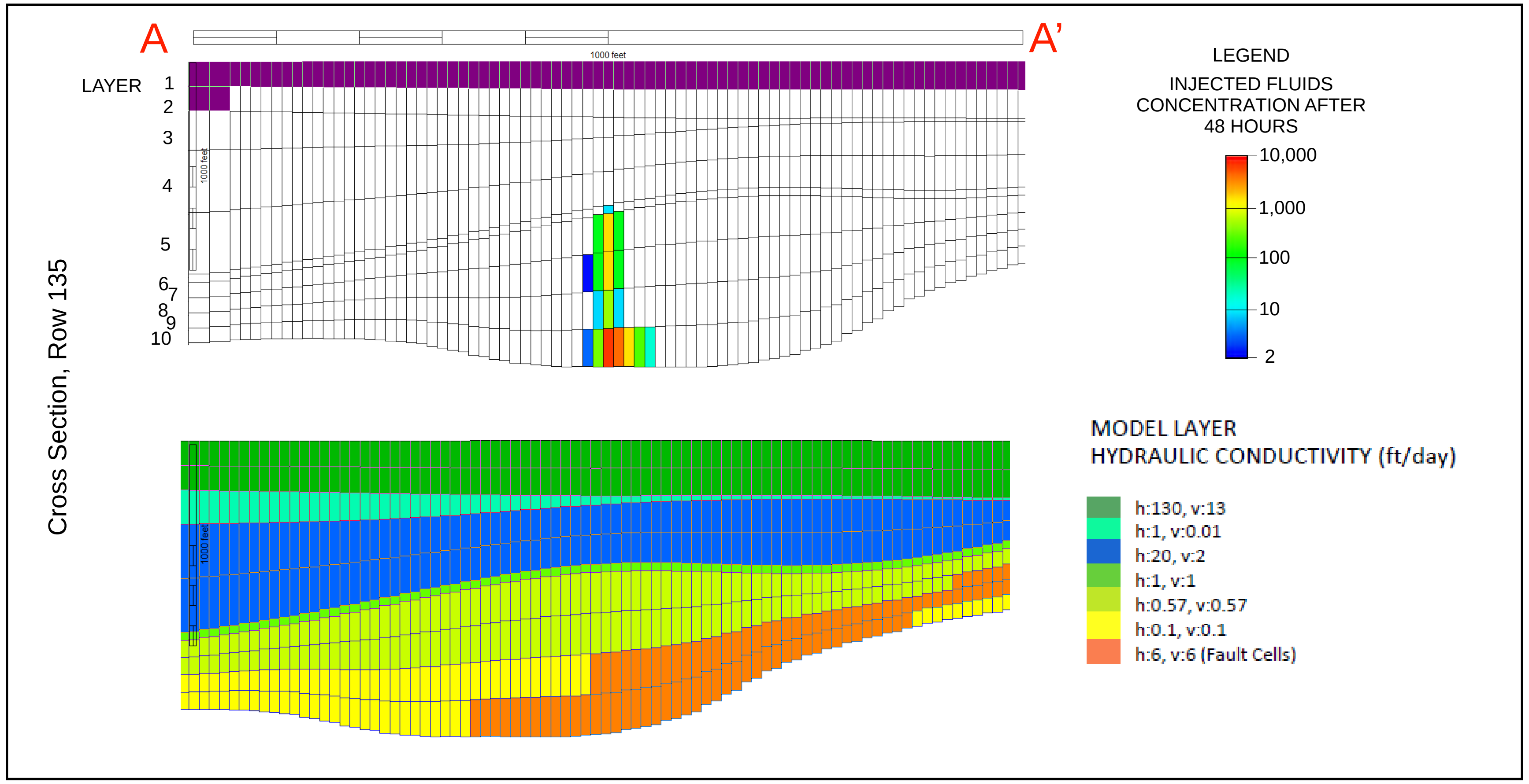
HALEY ALDRICH

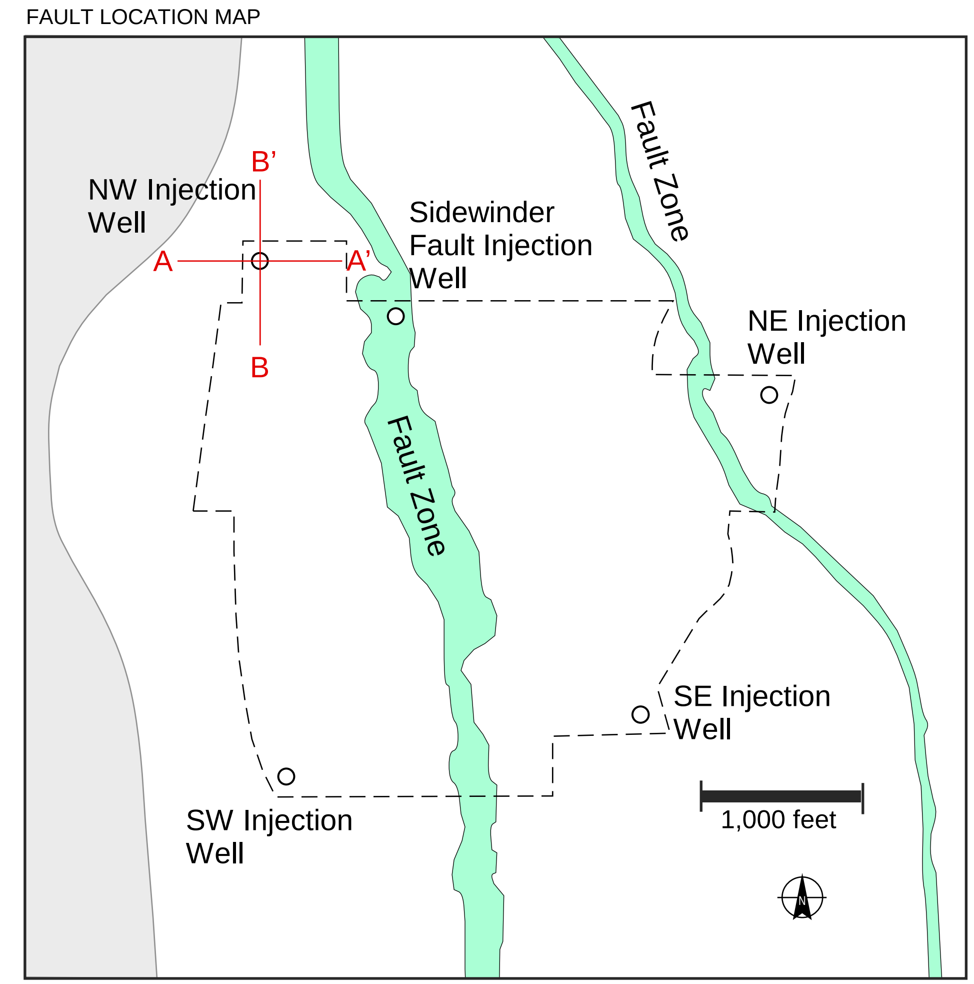
FLORENCE COPPER, INC.
FLORENCE, ARIZONA

LOCATION OF SUBJECT WELLS

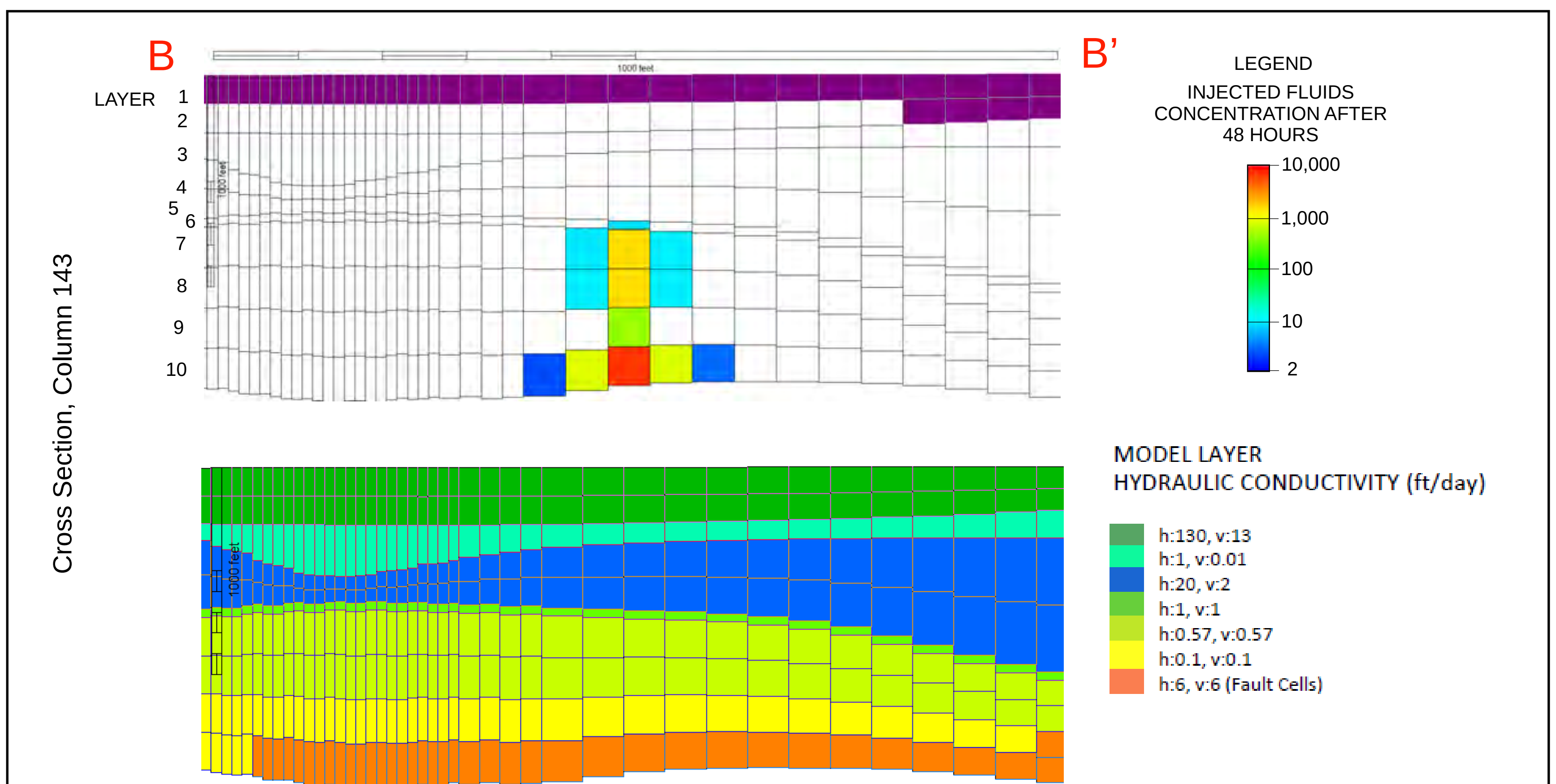
MARCH 2021

FIGURE 1





Lorem ipsum

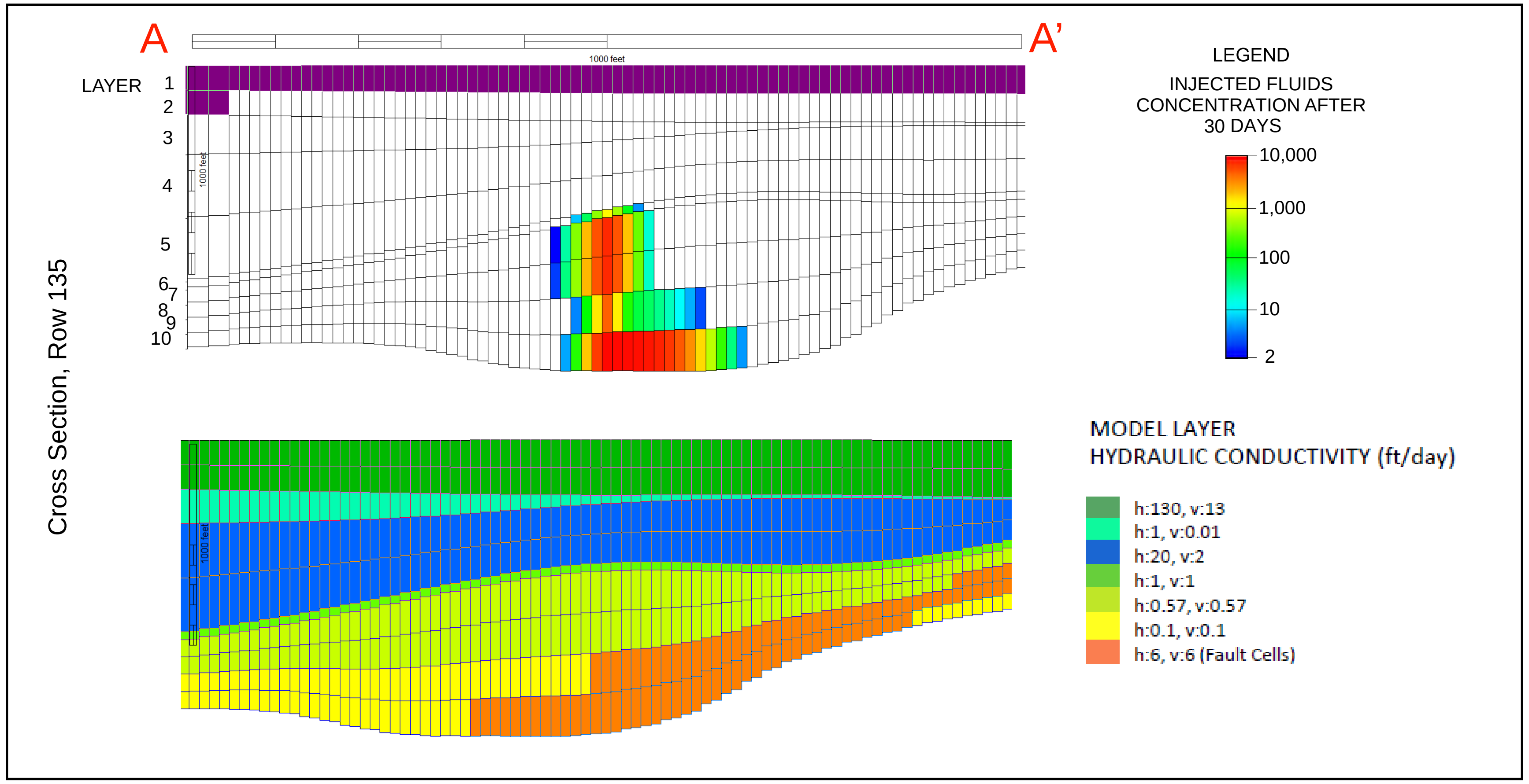


HALEY ALDRICH

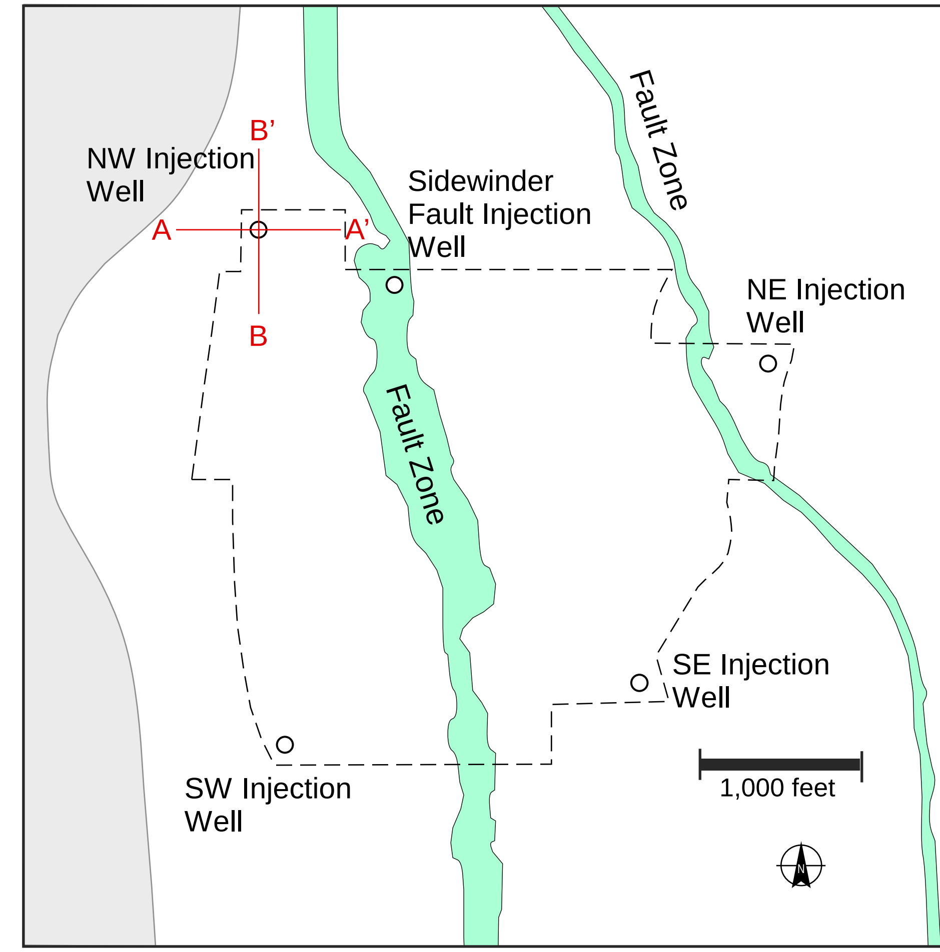
CROSS SECTIONS
NW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

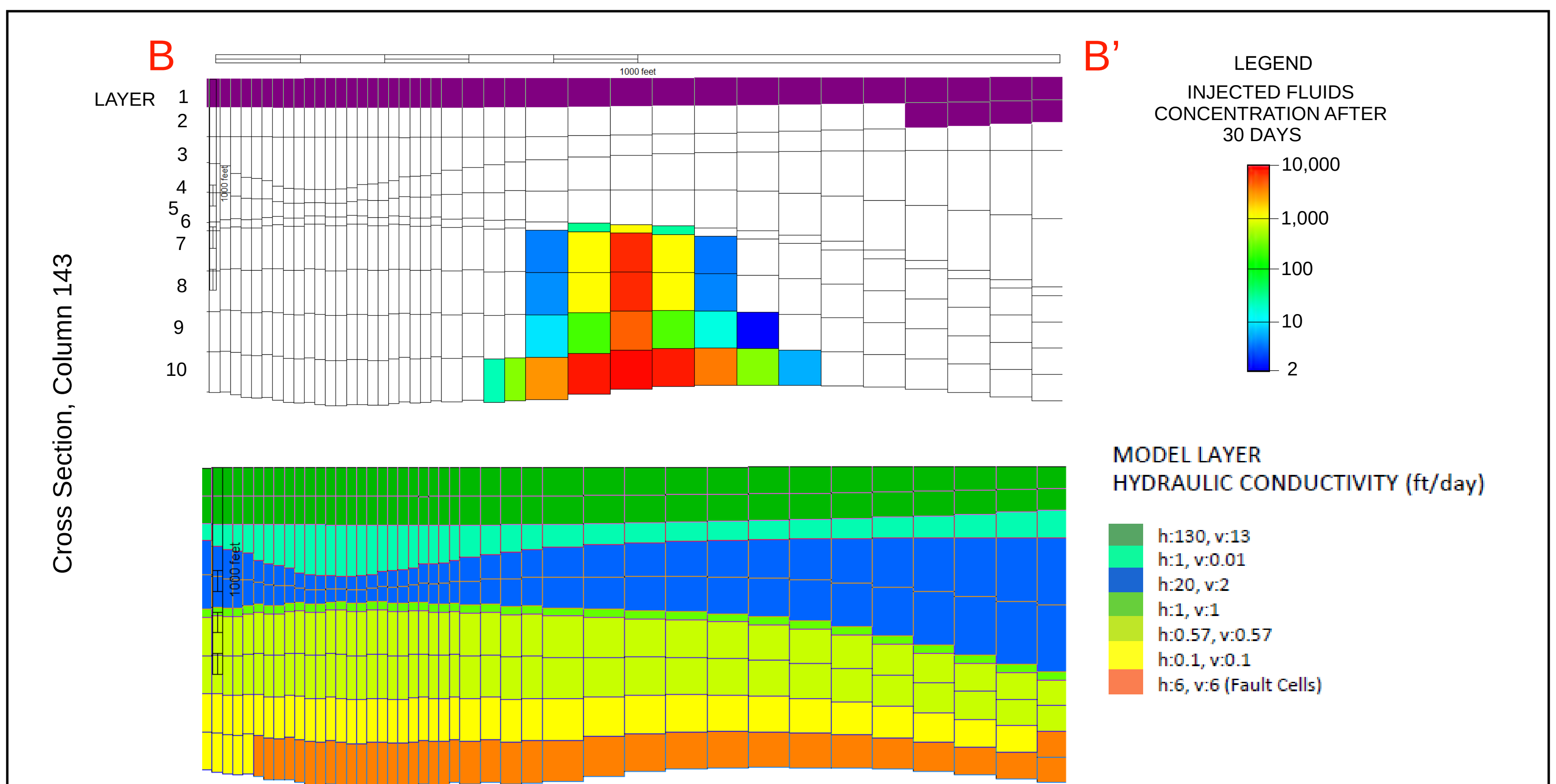
MARCH 2021

FIGURE 2



FAULT LOCATION MAP



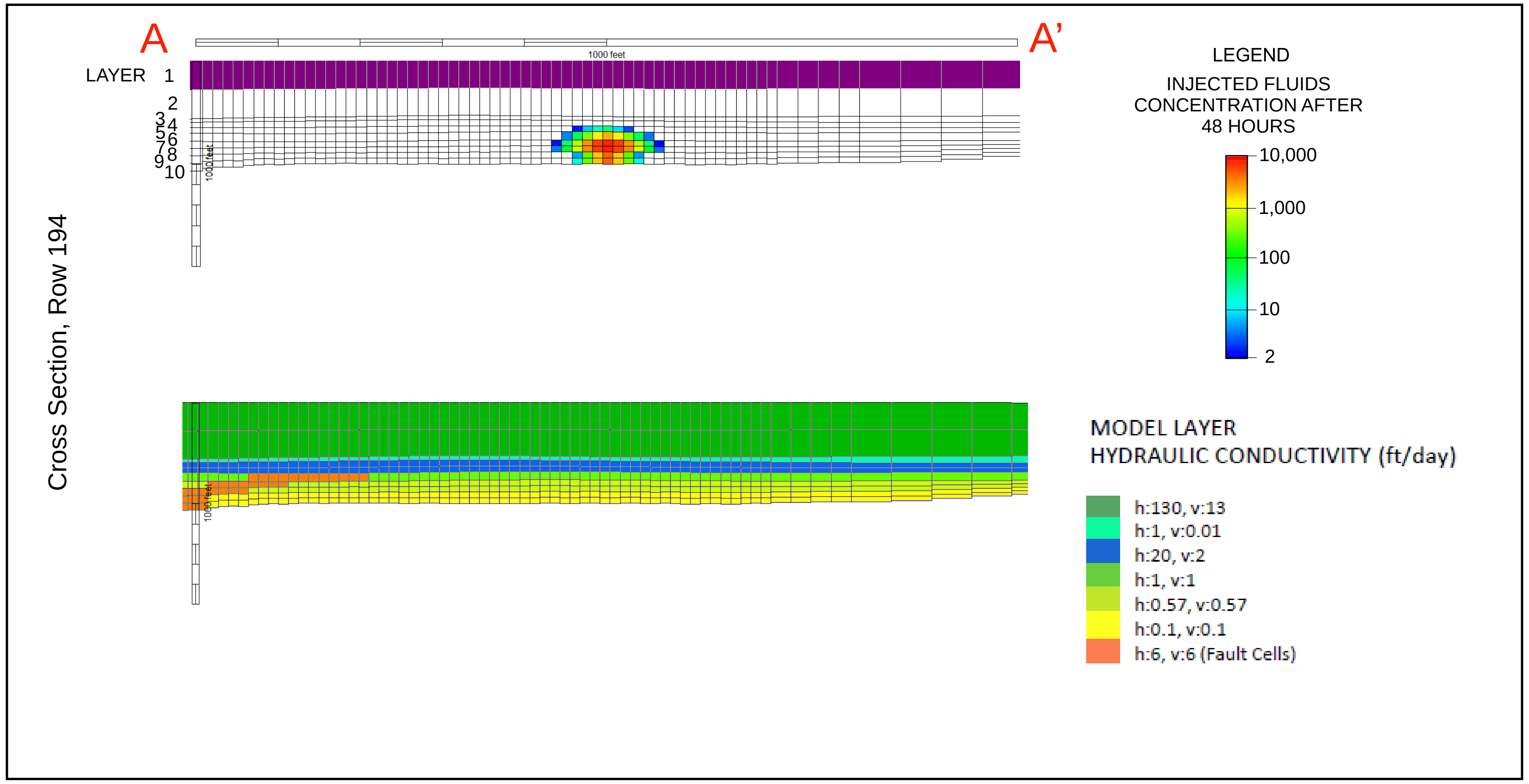


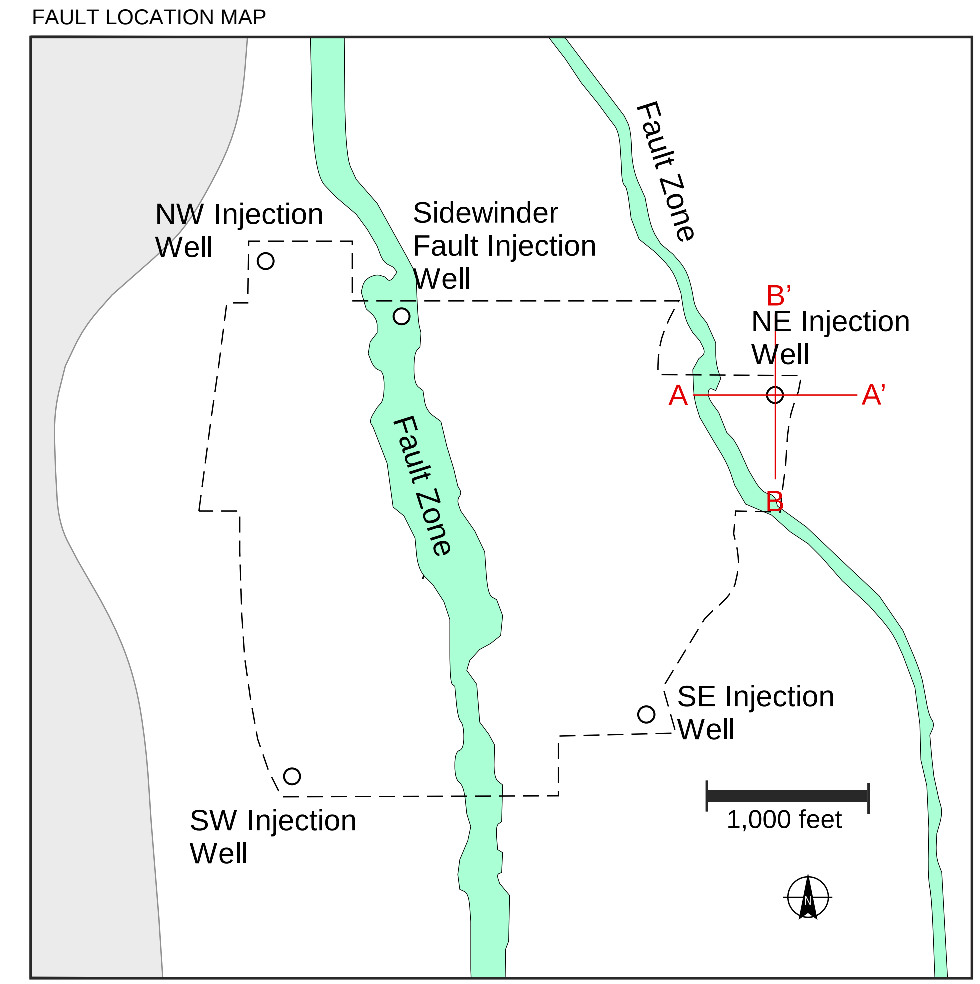
HALEY ALDRICH

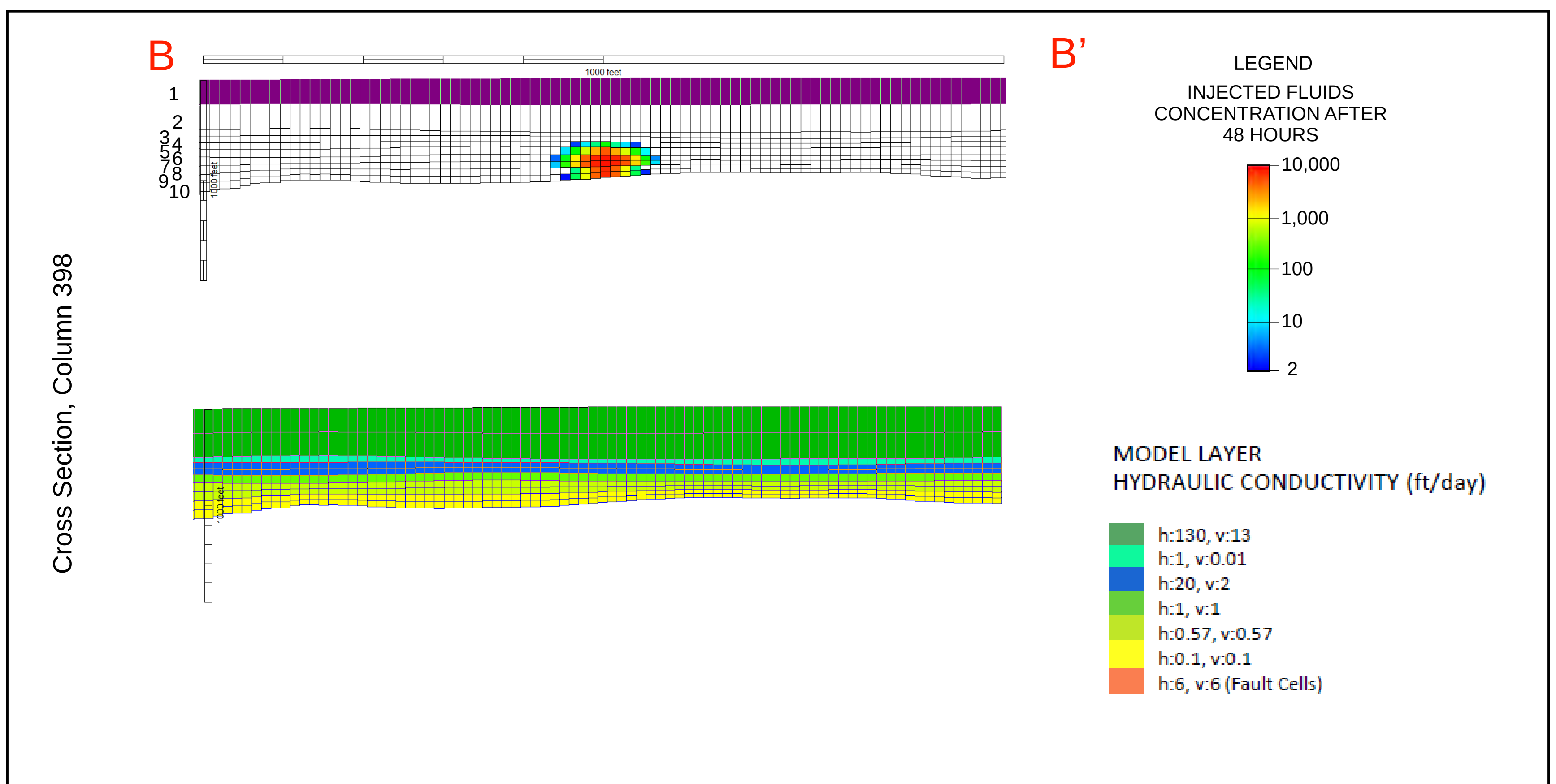
CROSS SECTIONS
NW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

MARCH 2021

FIGURE 3





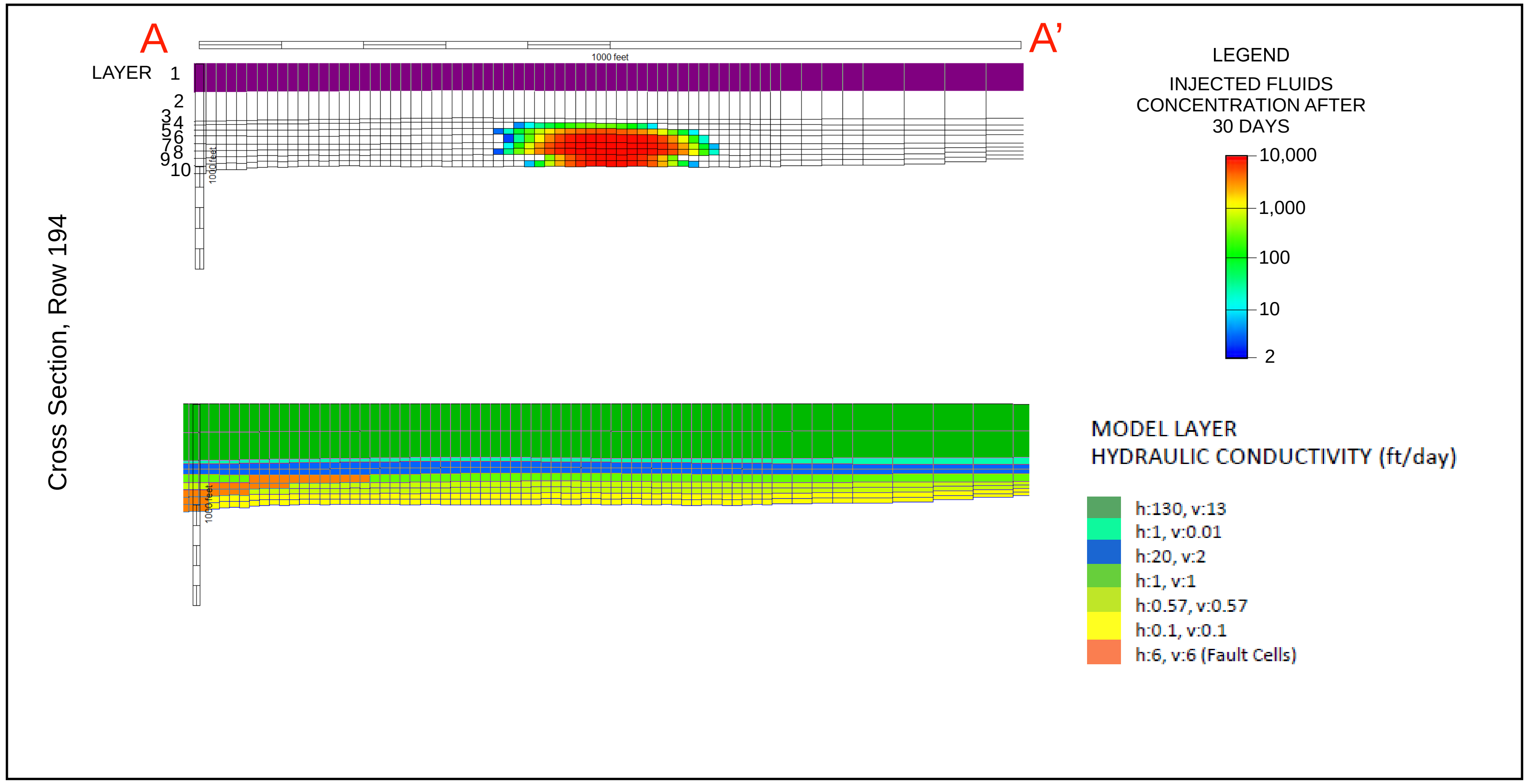


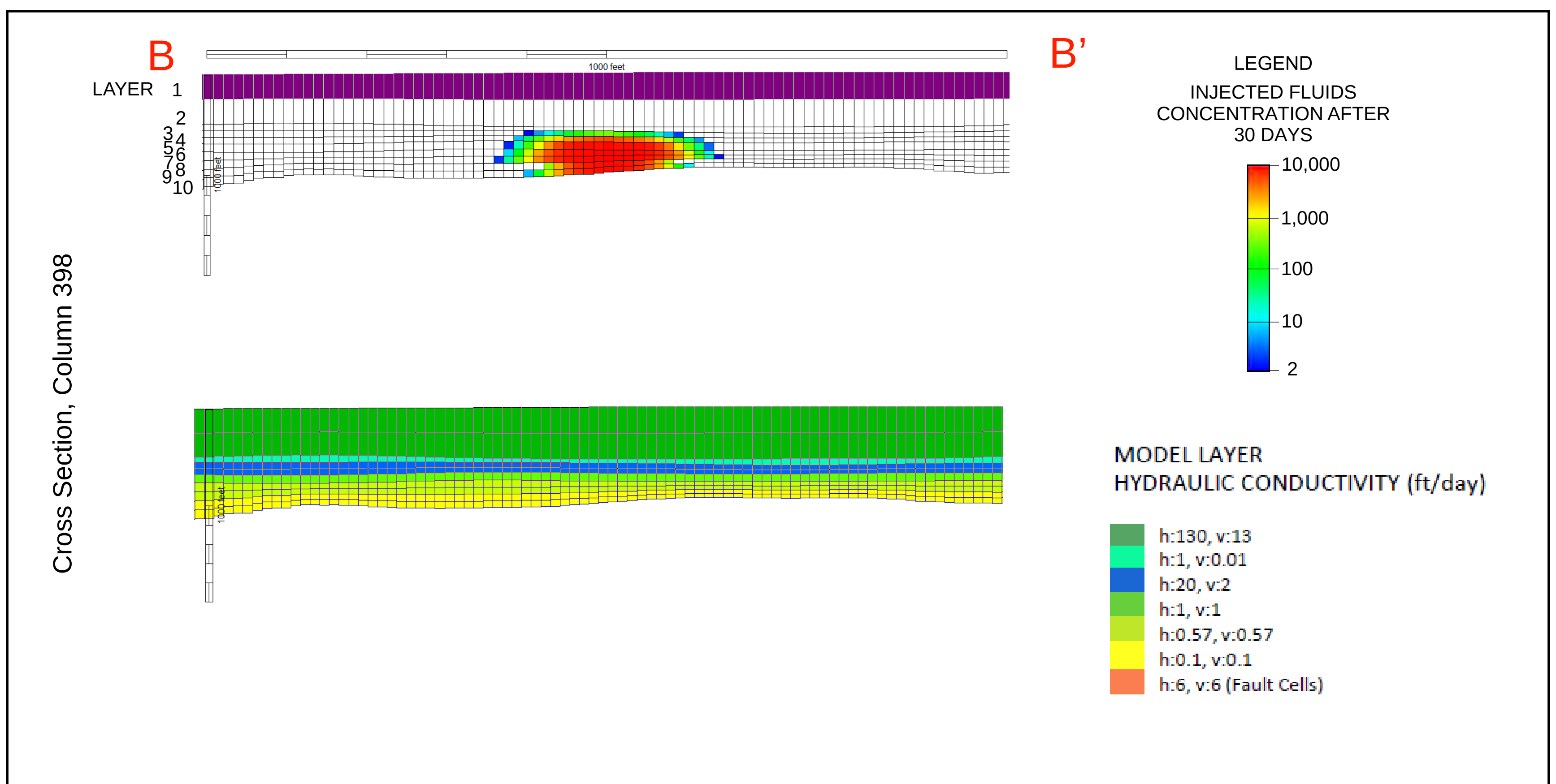
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

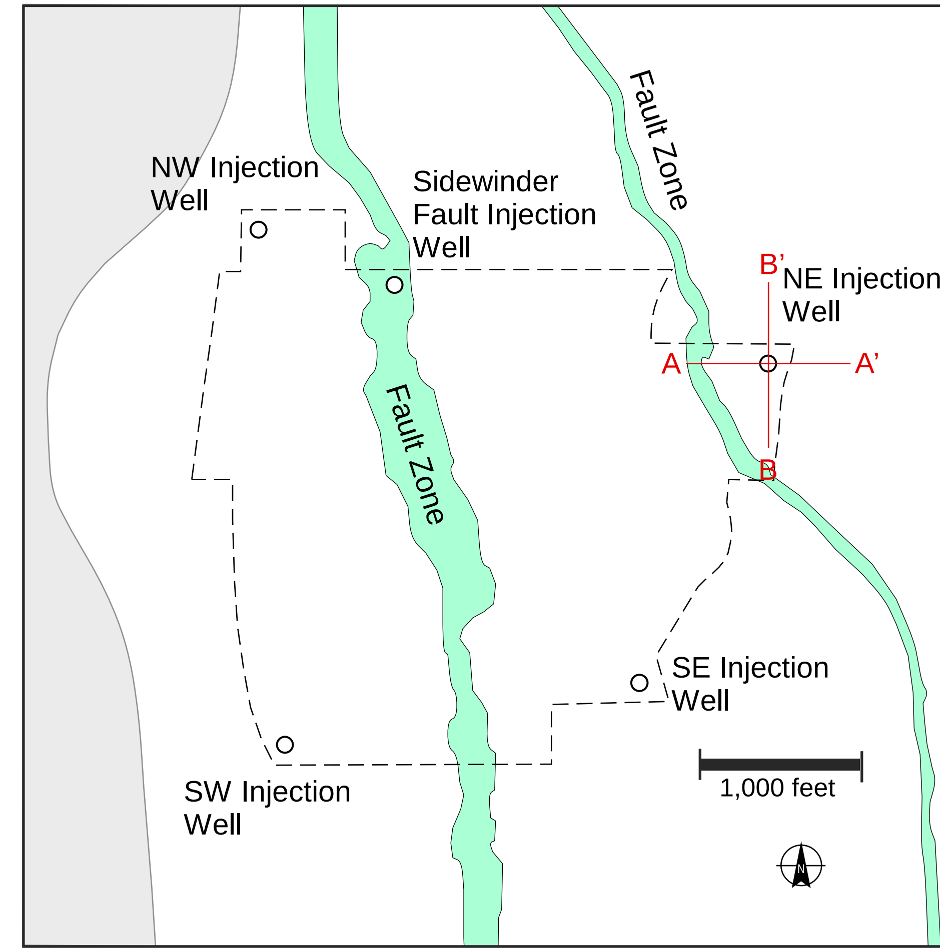
MARCH 2021

FIGURE 4





FAULT LOCATION MAP

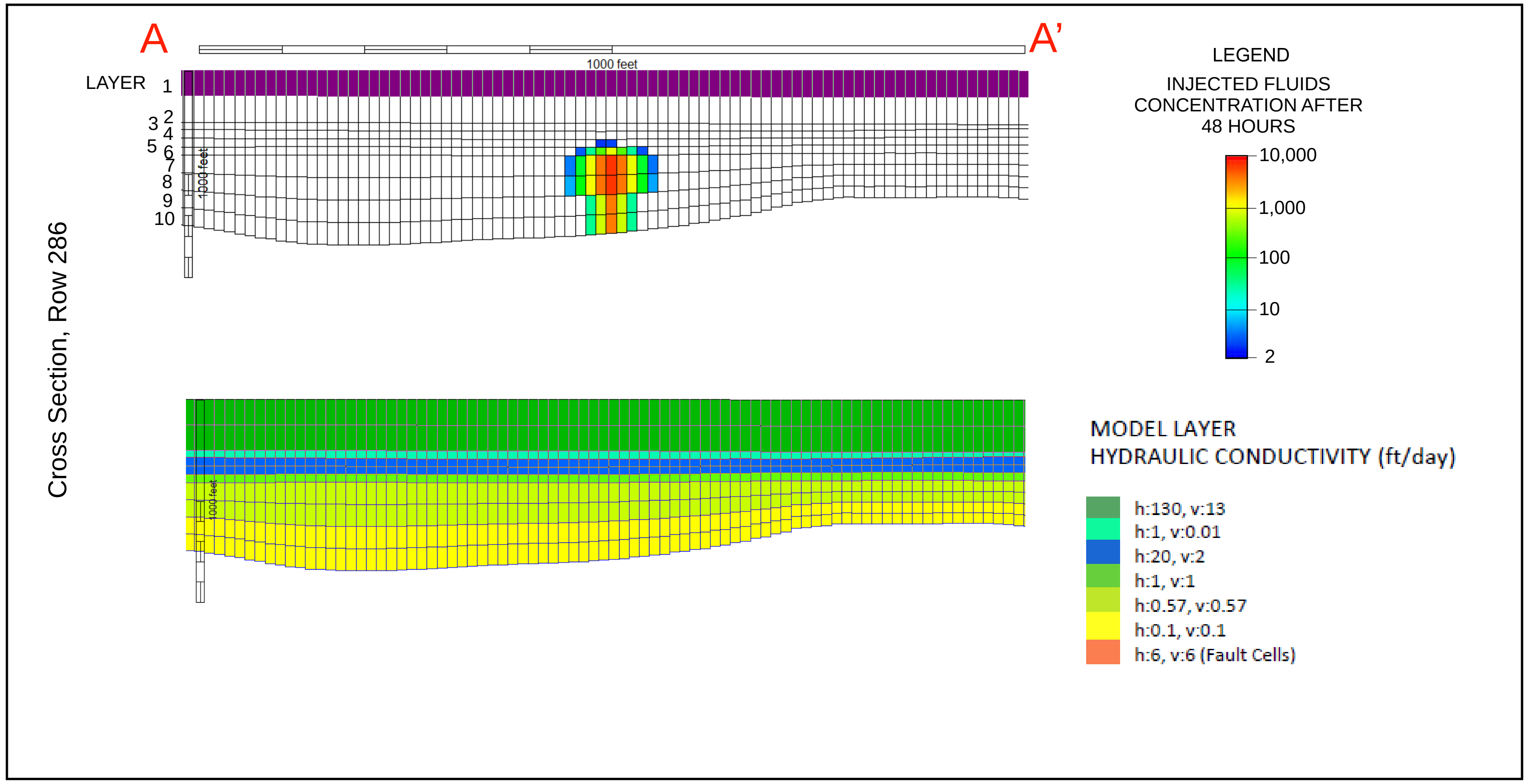


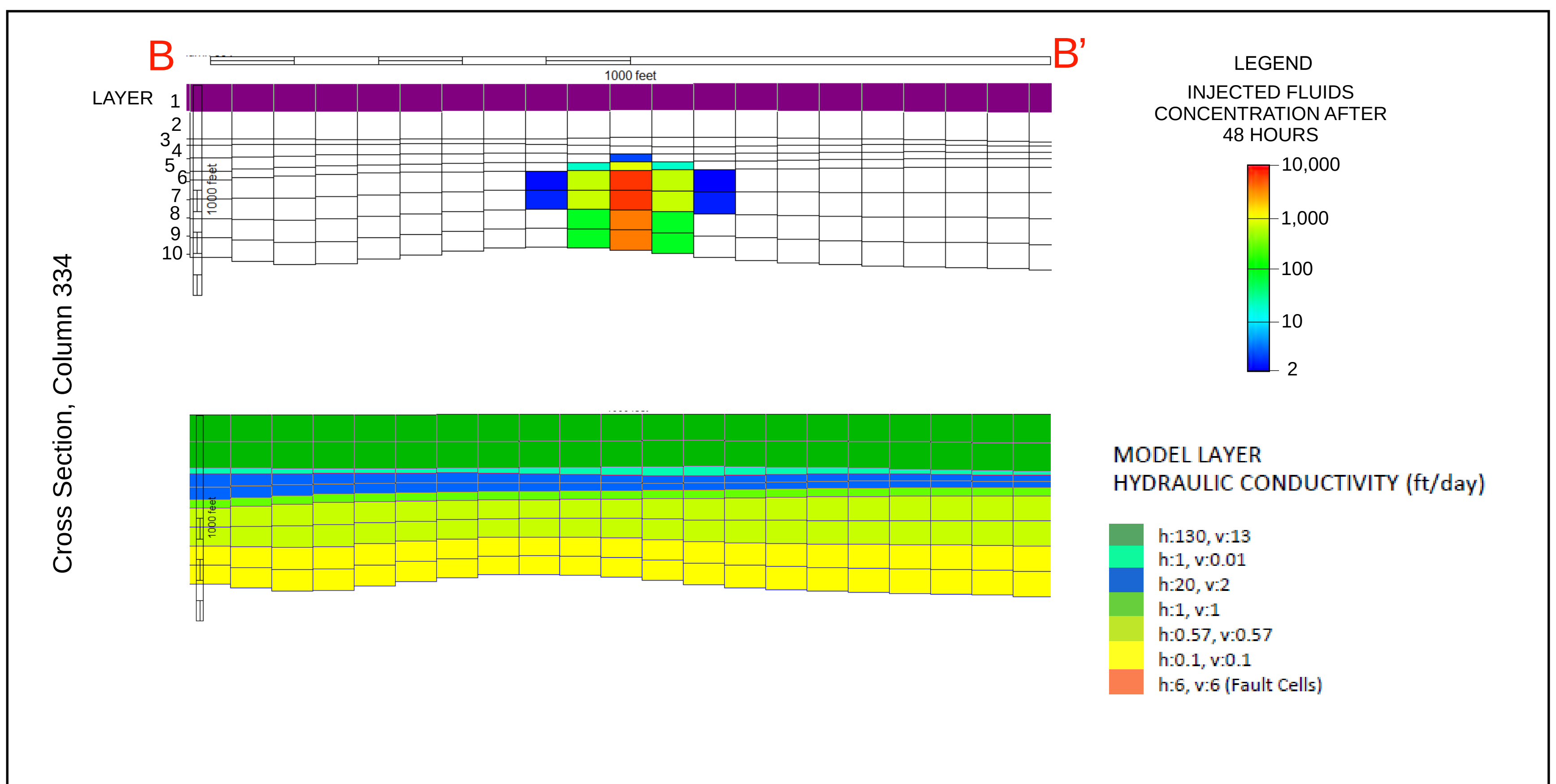
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

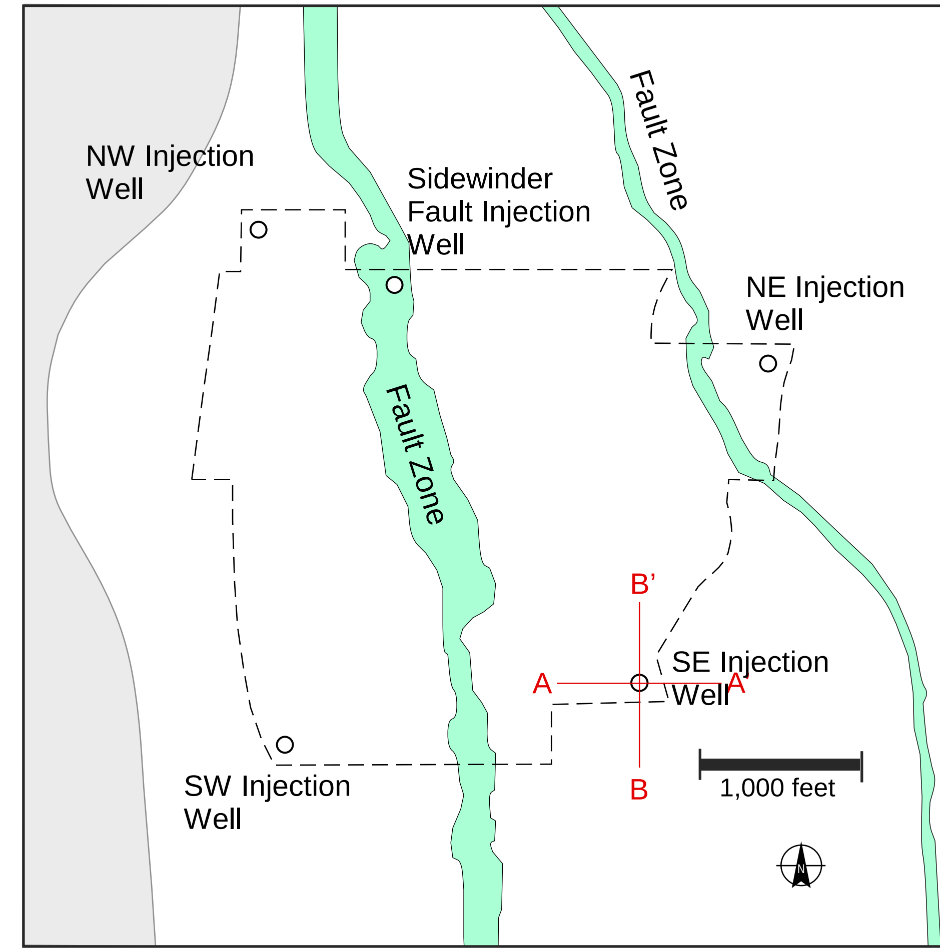
MARCH 2021

FIGURE 5





FAULT LOCATION MAP

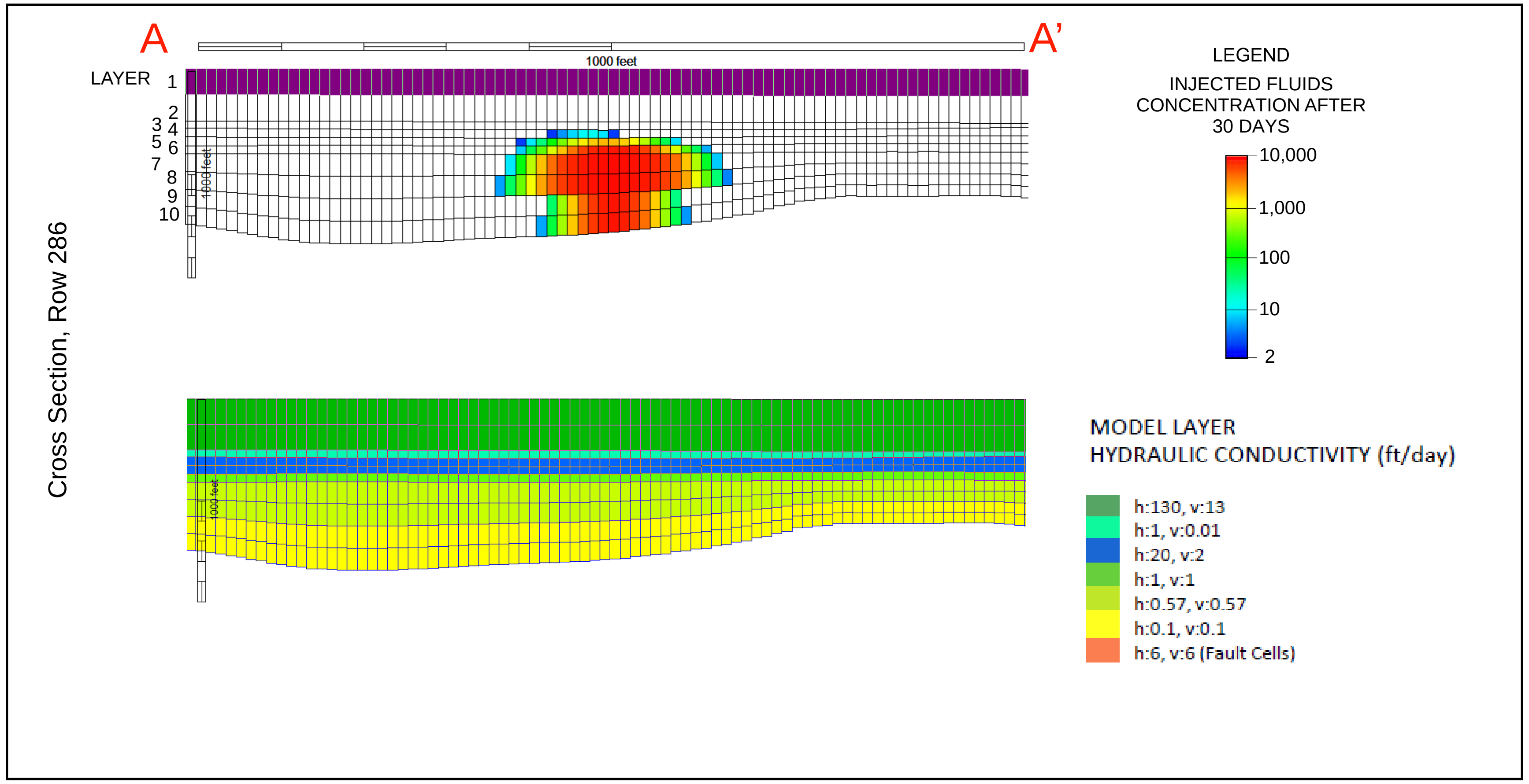


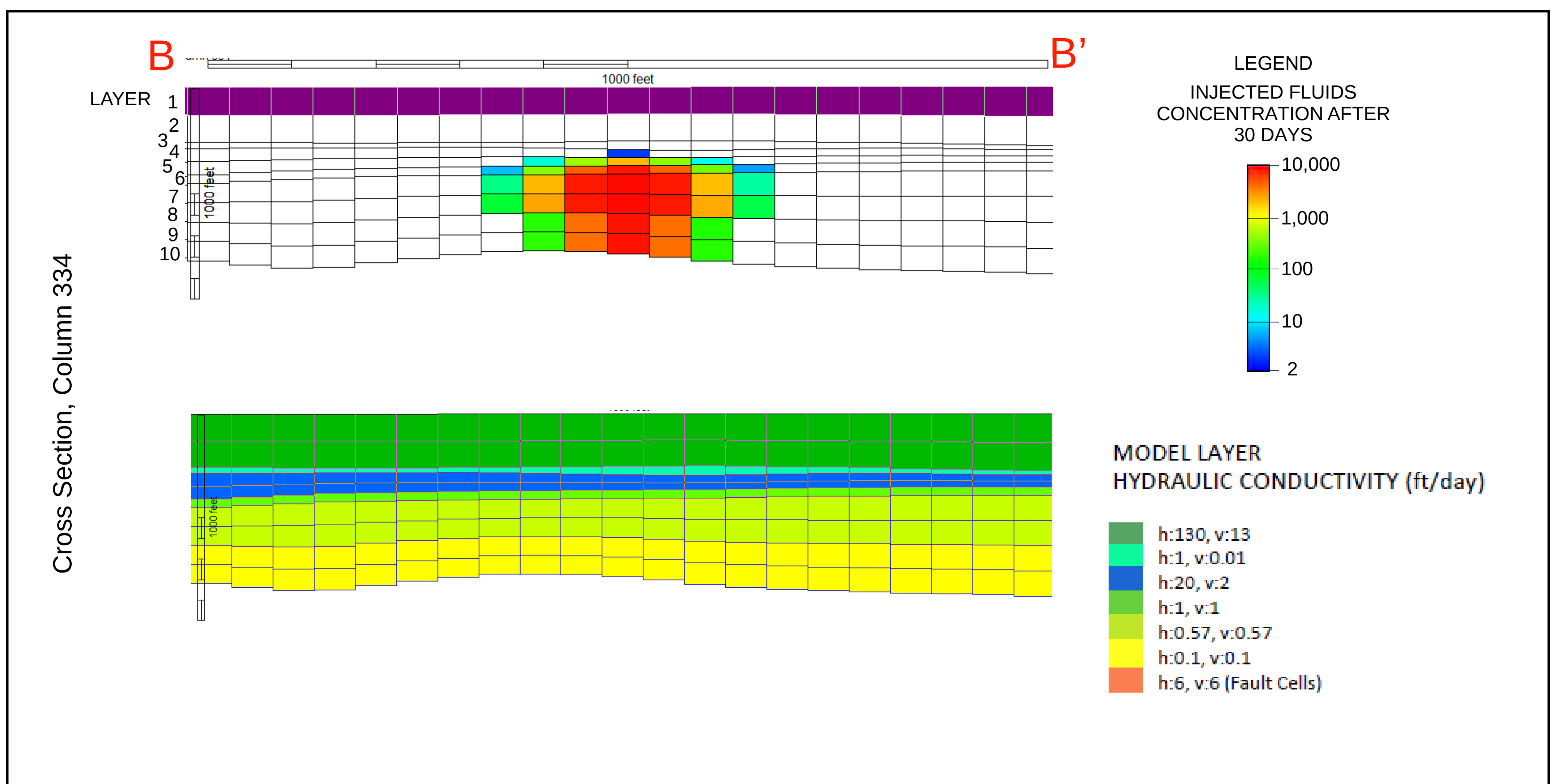
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

MARCH 2021

FIGURE 6





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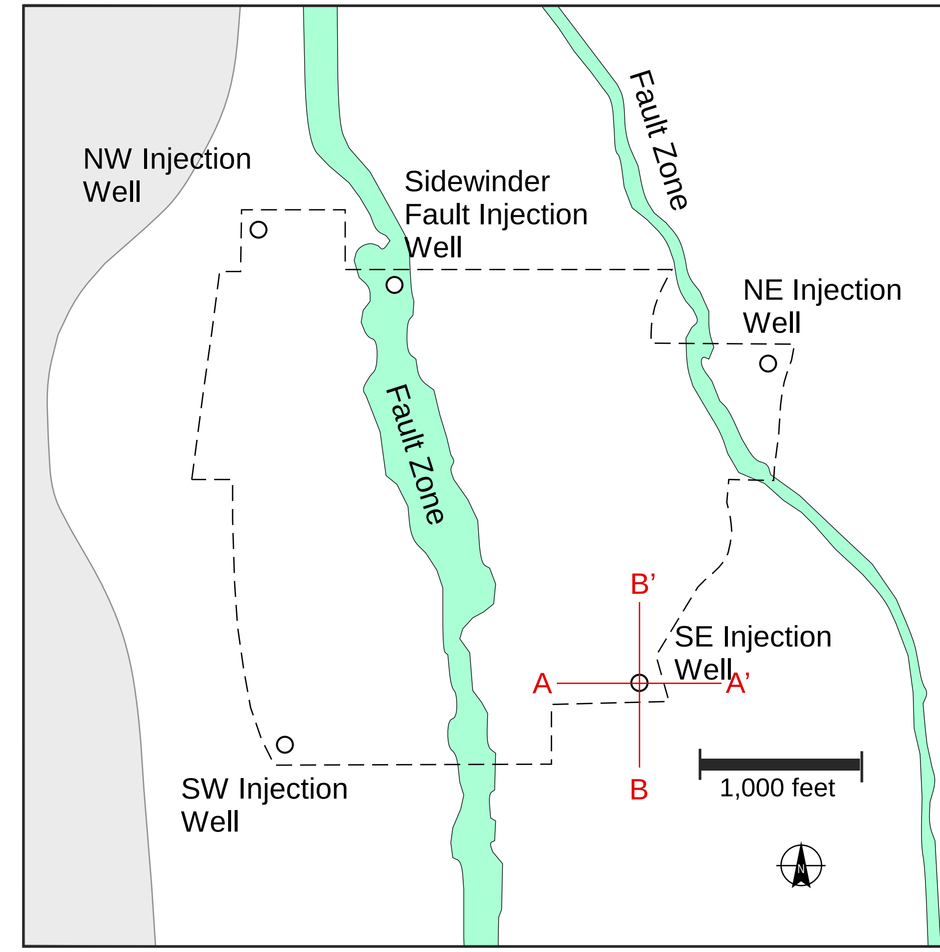
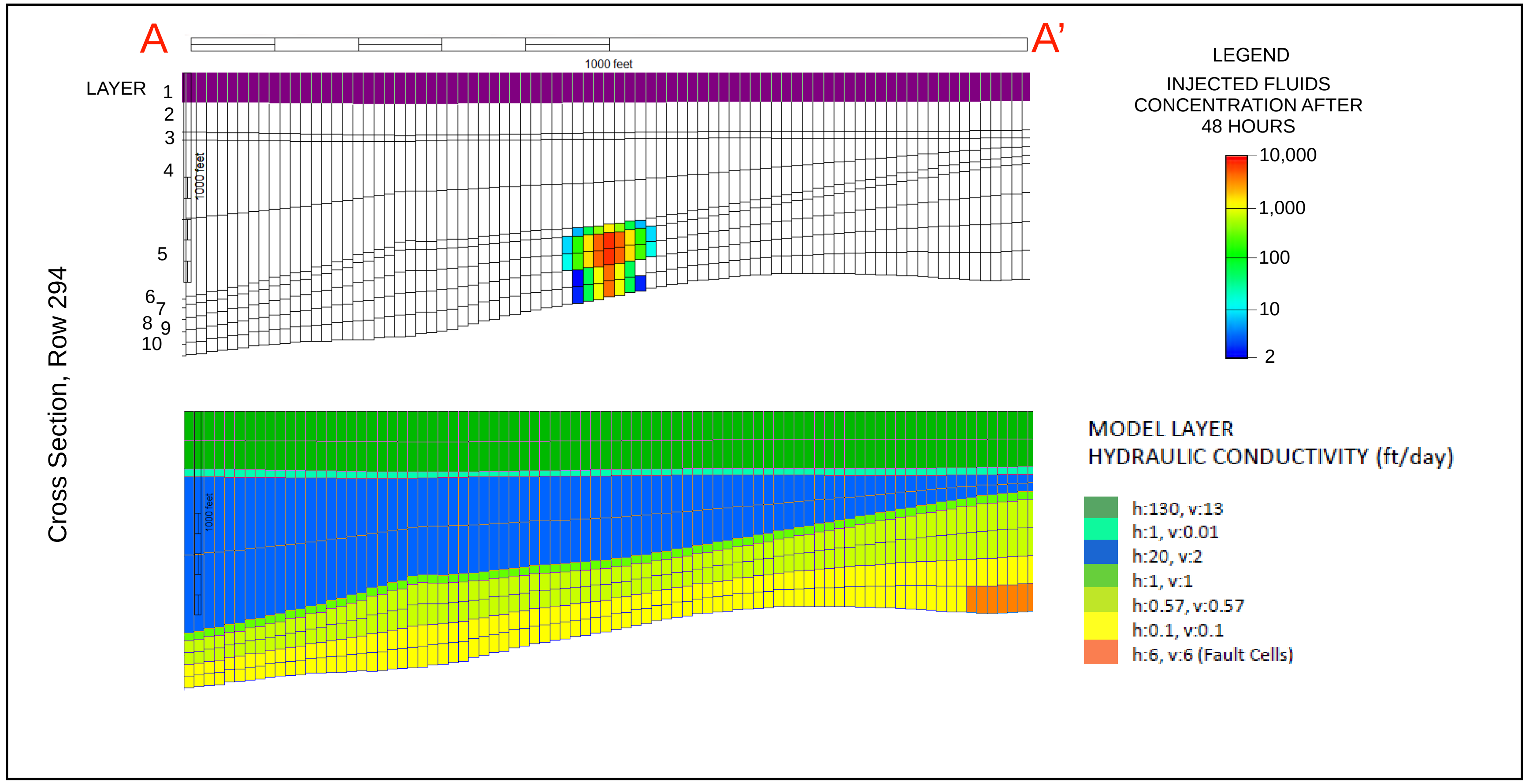
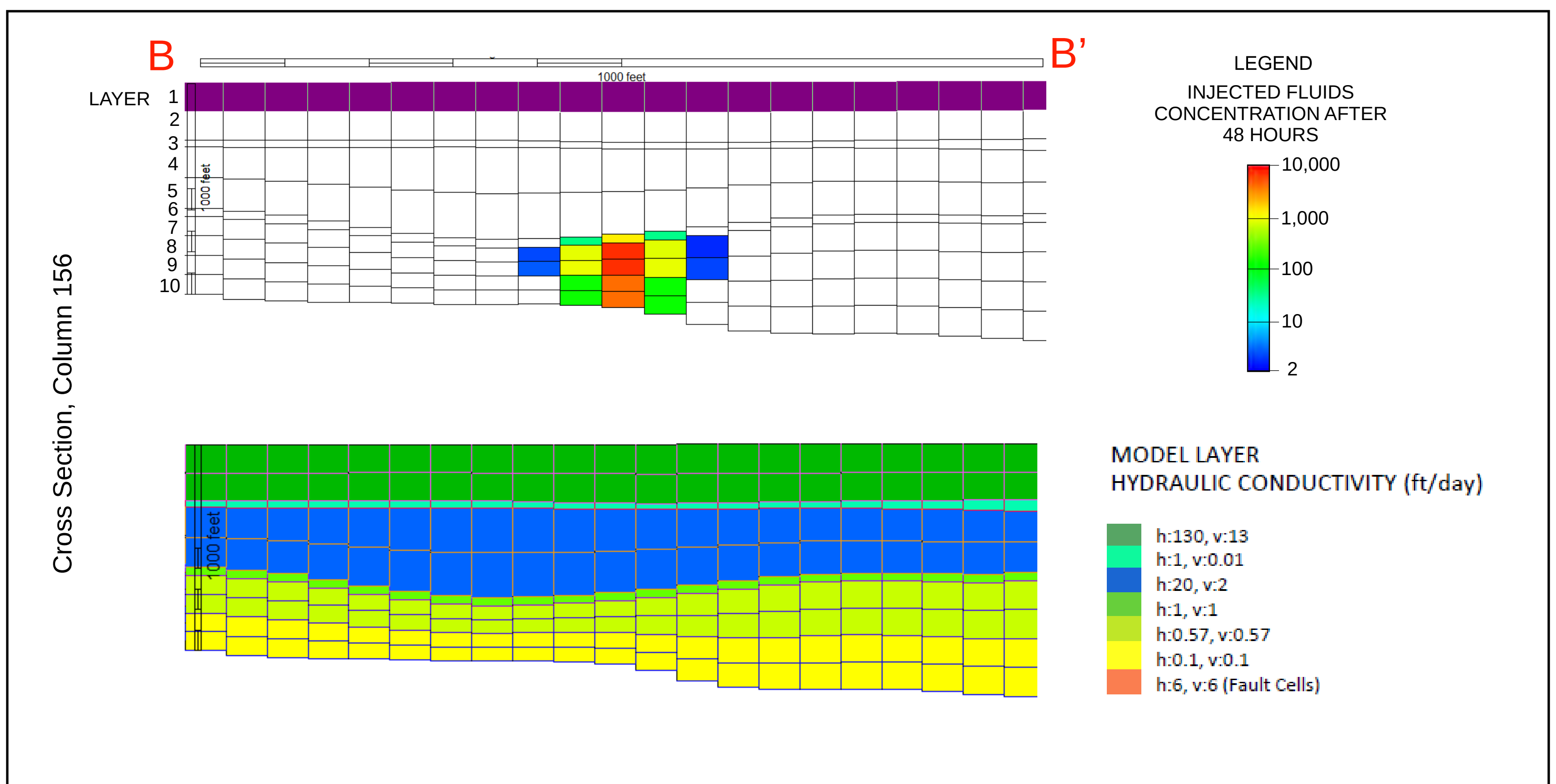


CROSS SECTIONS
SE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

MARCH 2021

FIGURE 7





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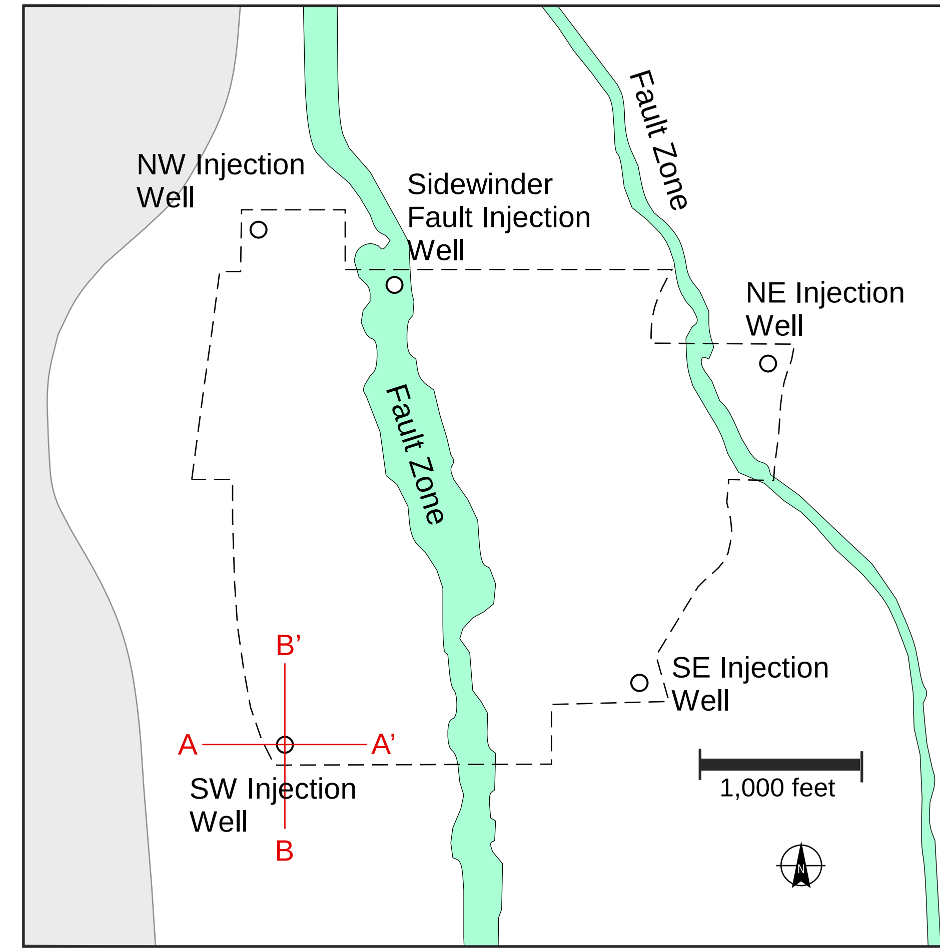
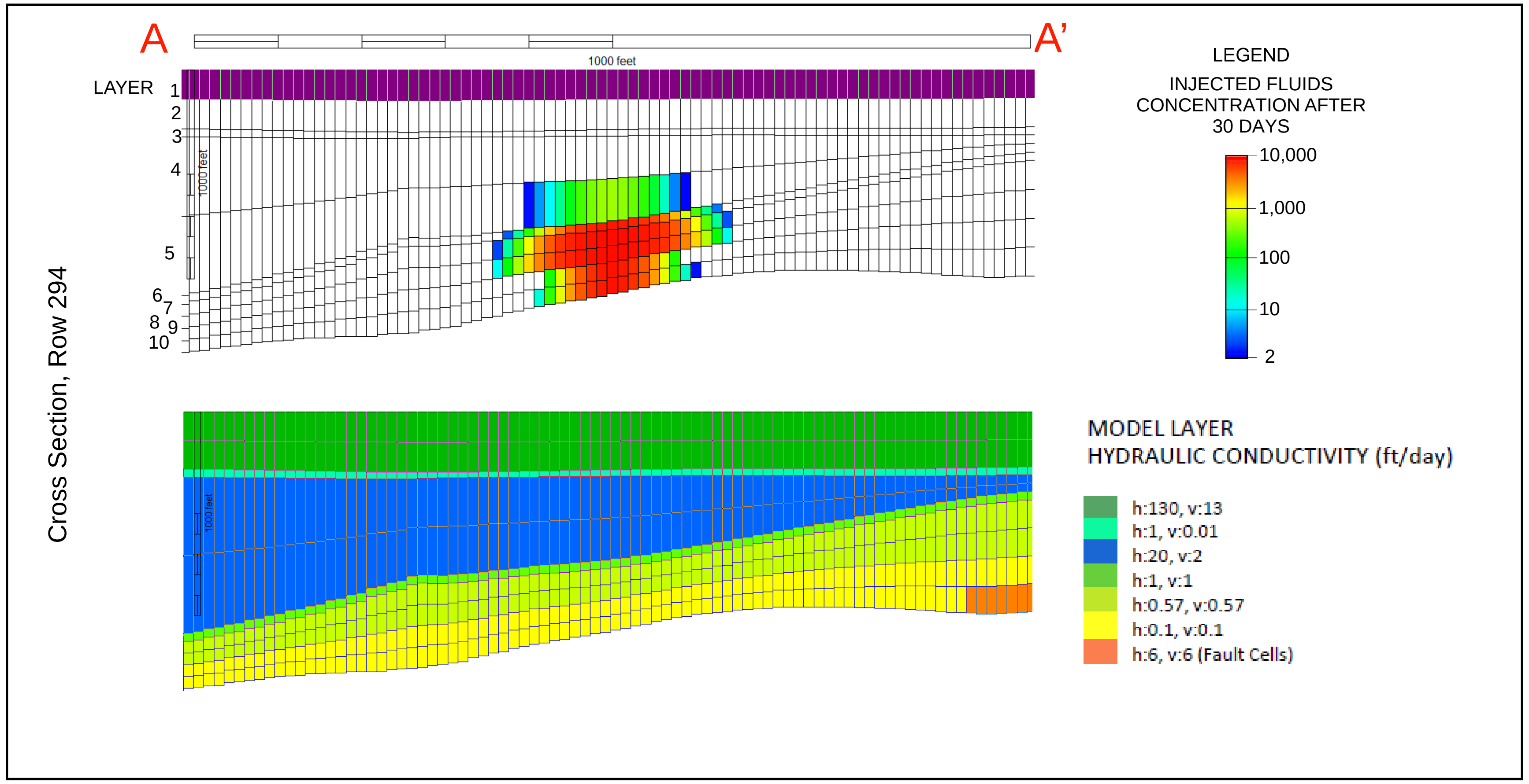


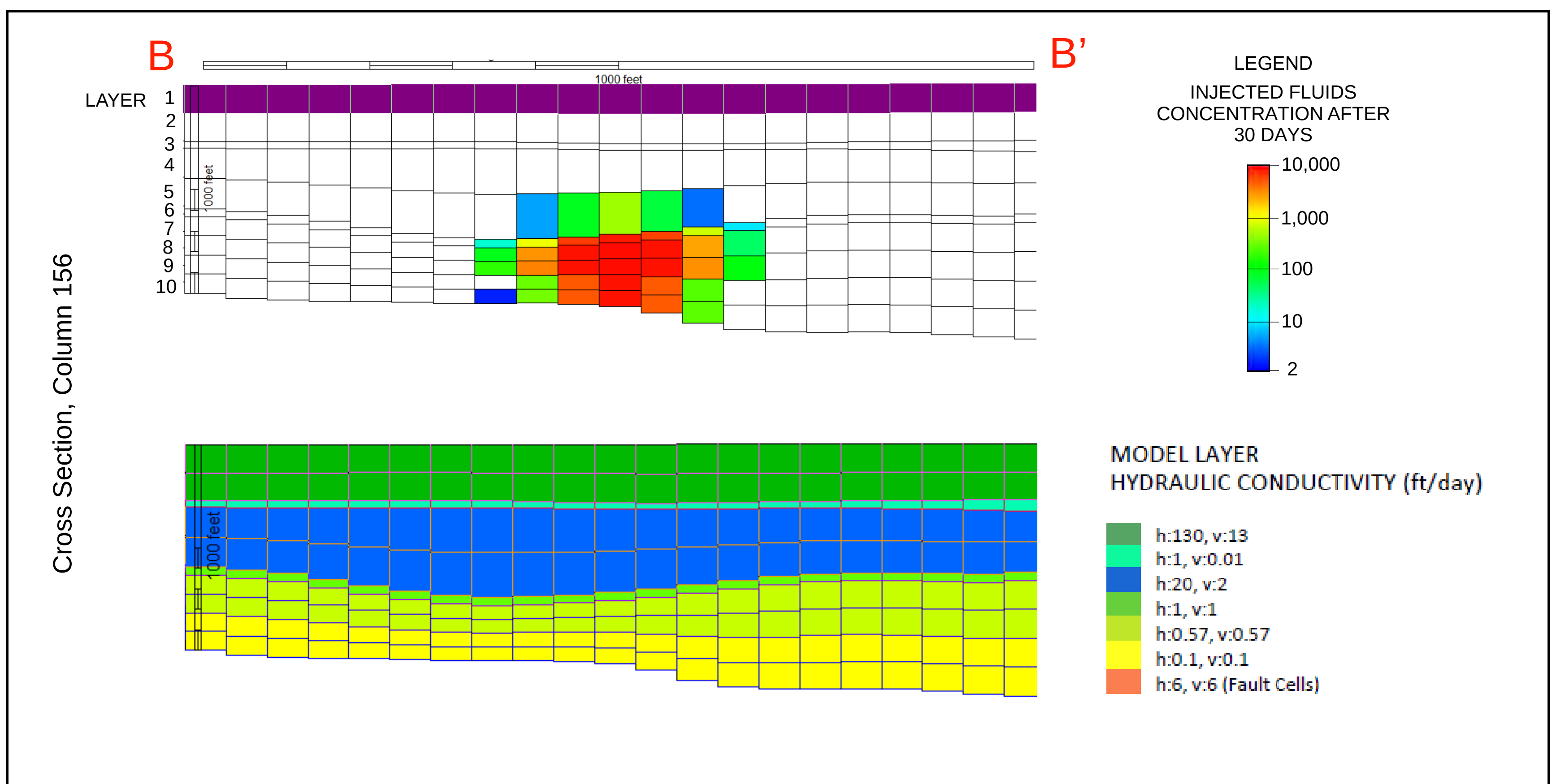
HALEY ALDRICH

CROSS SECTIONS
SW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

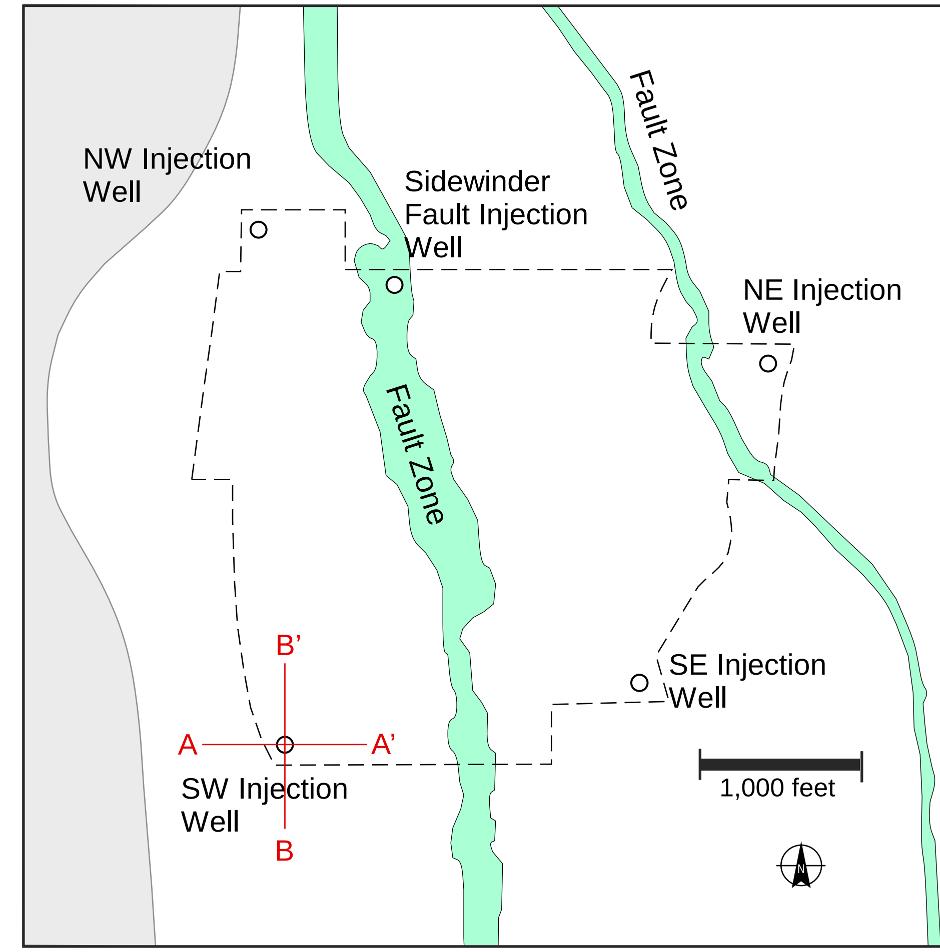
MARCH 2021

FIGURE 8





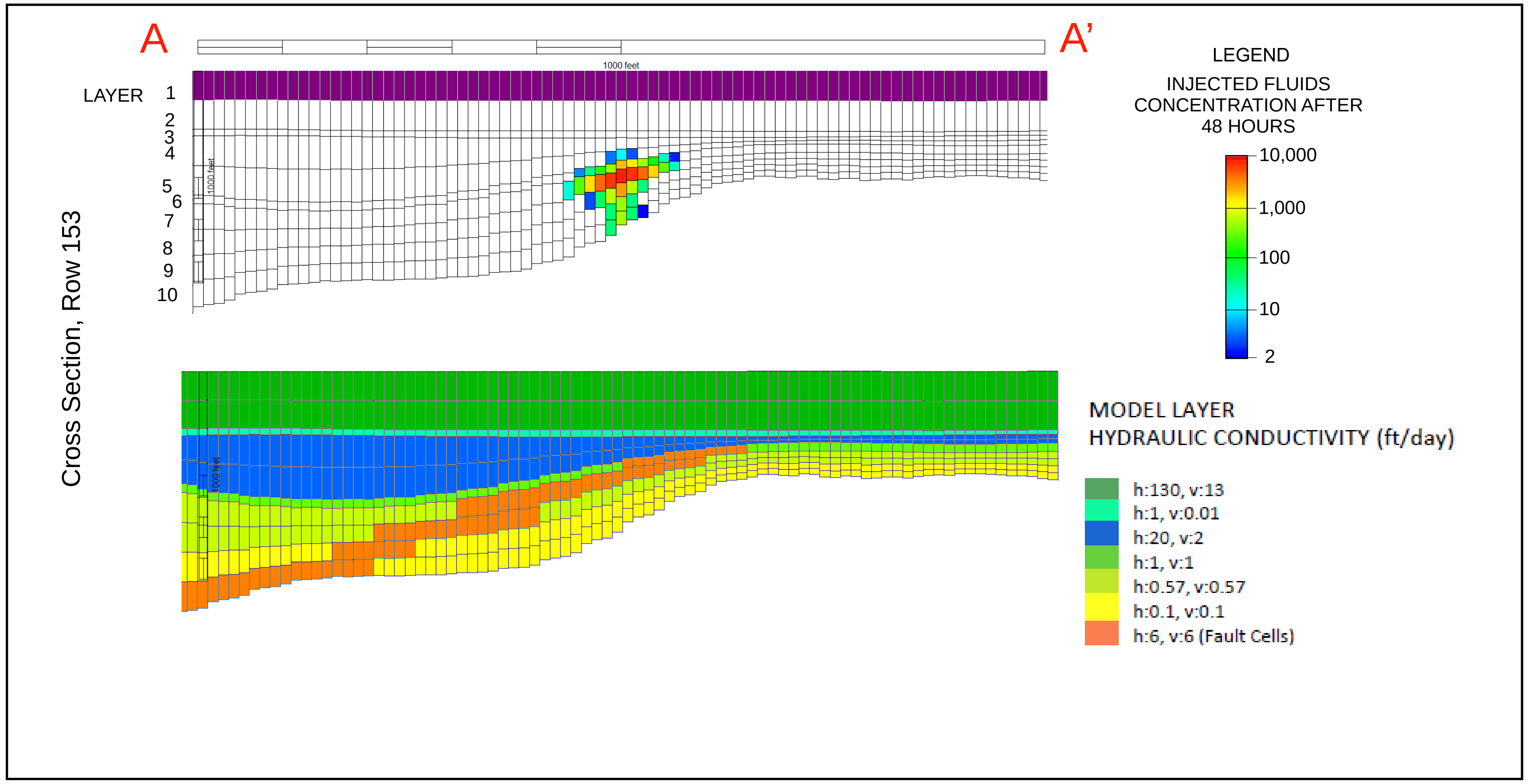
FAULT LOCATION MAP

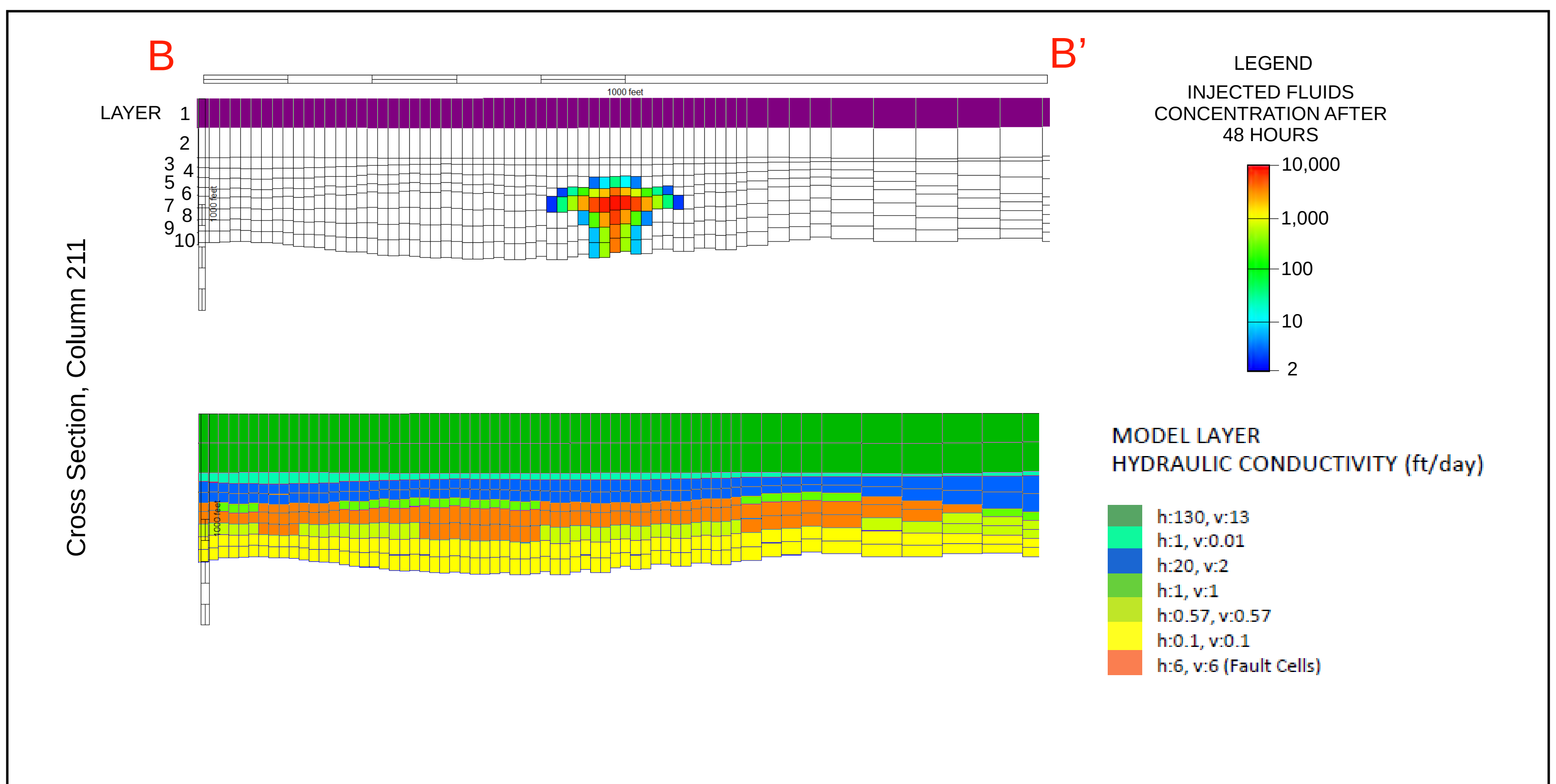


CROSS SECTIONS
SW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

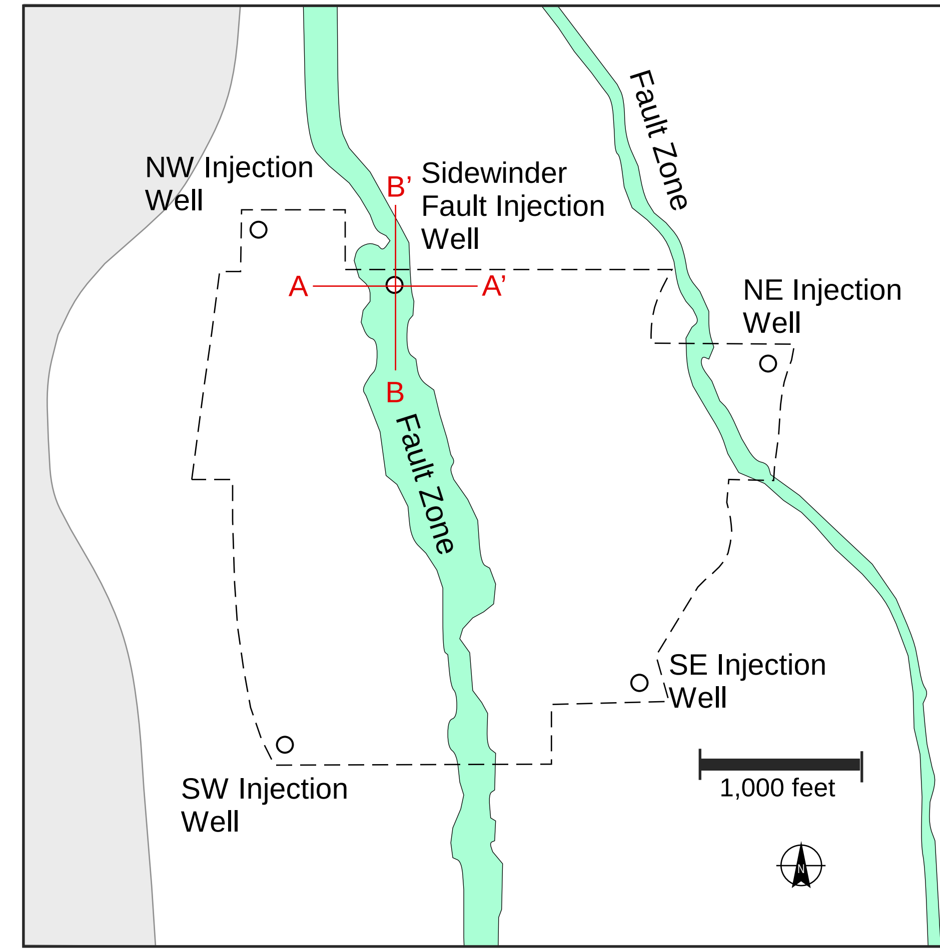
MARCH 2021

FIGURE 9





FAULT LOCATION MAP

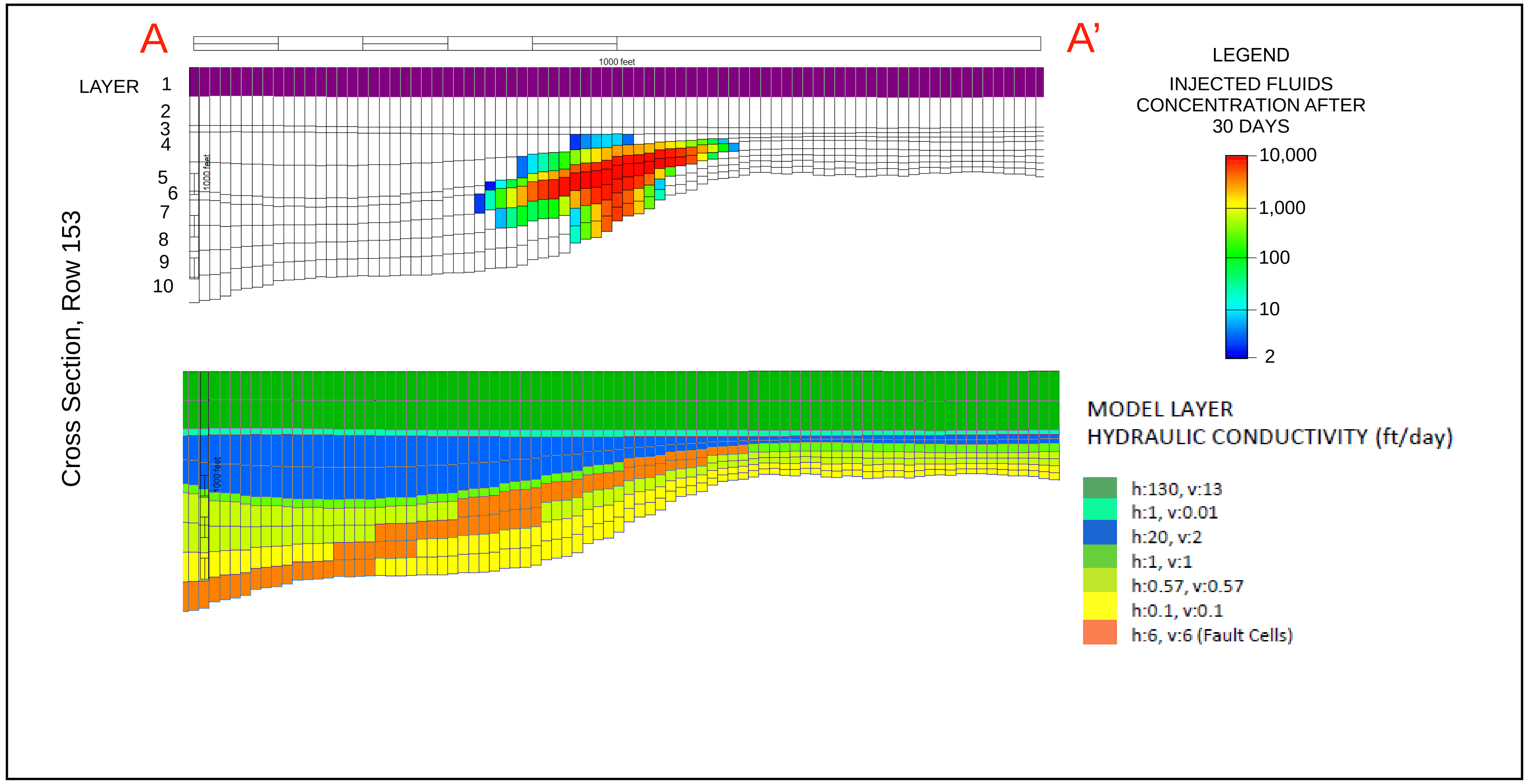


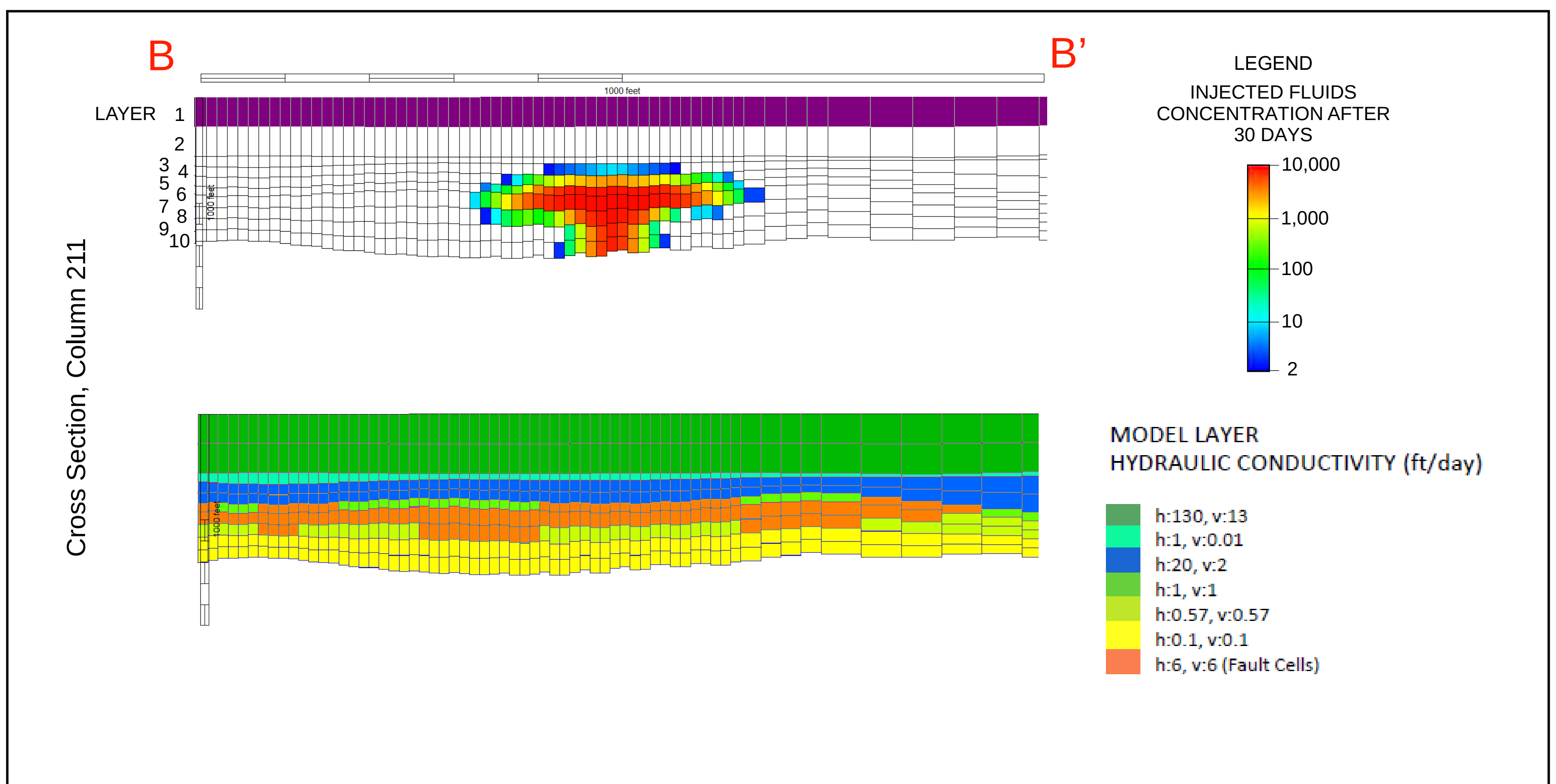
HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 48 HOUR INJECTION WITH NO EXTRACTION

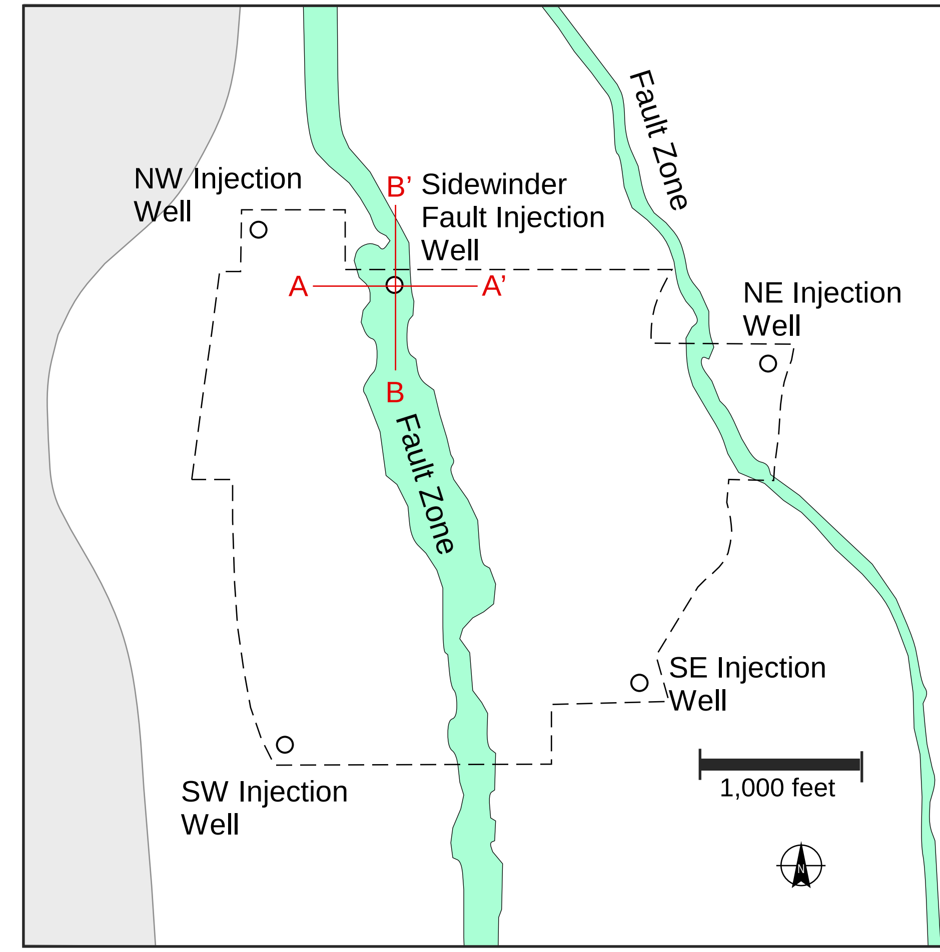
MARCH 2021

FIGURE 10





FAULT LOCATION MAP

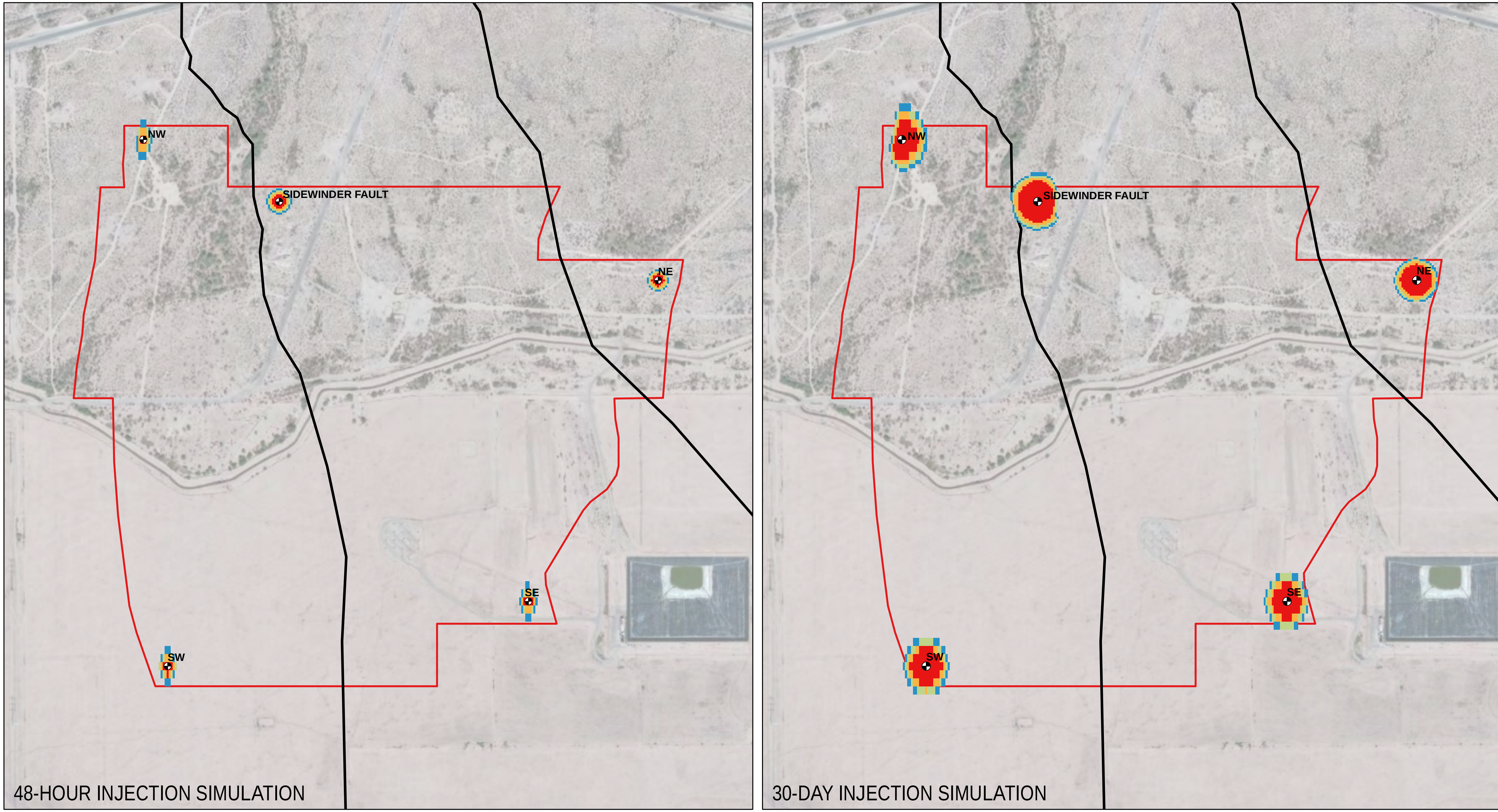


HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 30 DAY INJECTION WITH NO EXTRACTION

MARCH 2021

FIGURE 11



LEGEND

- INJECTION WELL
- FAULT
- ISCR WELLFIELD

SOLUTE CONCENTRATION IN MILLIGRAMS PER LITER (mg/L)

- 1 TO 10
- 10 TO 100
- 100 TO 1000
- 1000 TO 10000

NOTES

1. ALL LOCATIONS AND DIMENTIONS ARE APPROXIMATE.
2. SIMULATED SOLUTE CONCENTRATIONS ARE FROM MODEL LAYER 7, EXCEPT THE NW INJECTION WELL WHICH USED MODEL LAYER 10.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 600 1,200

SCALE IN FEET

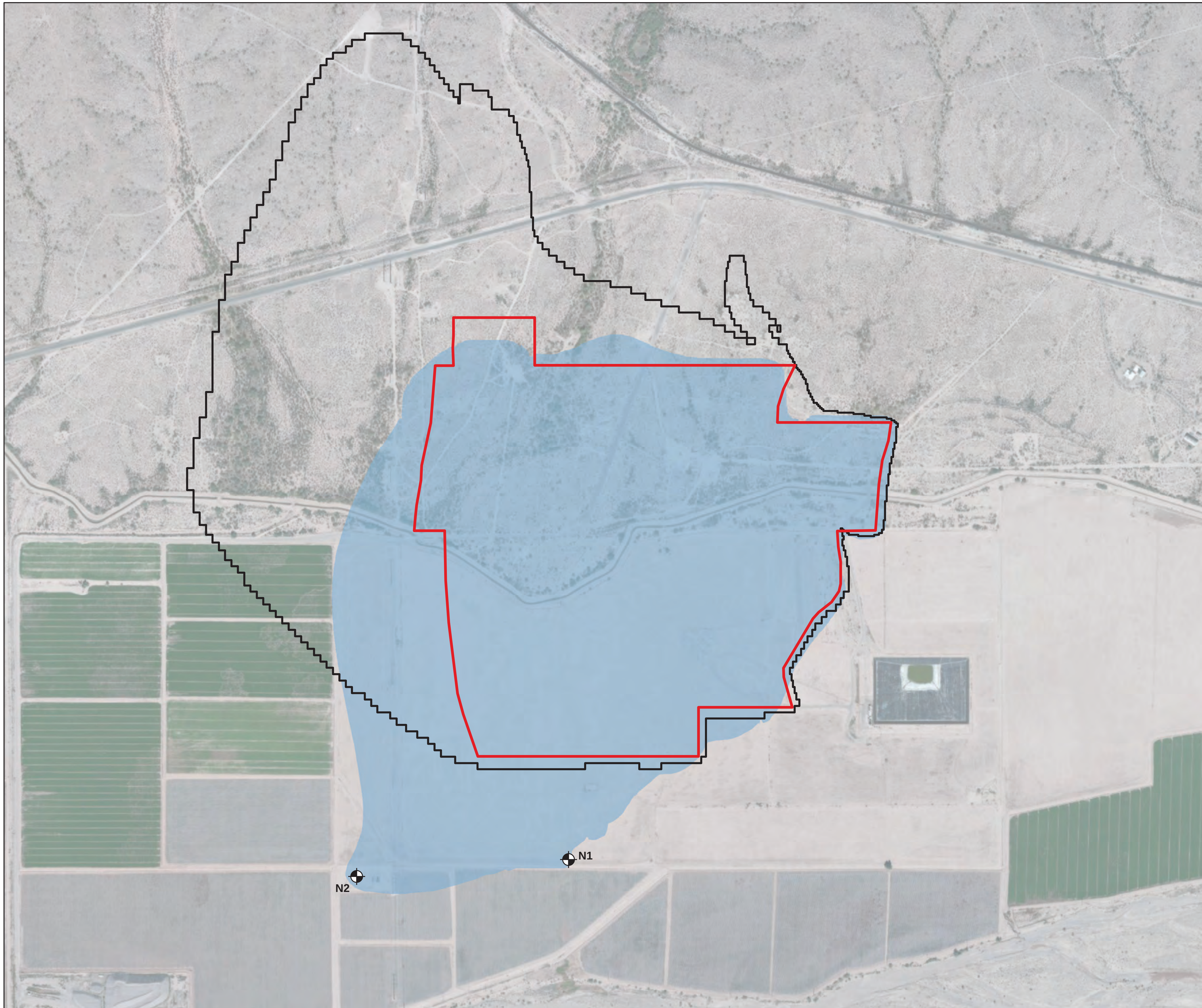
HALEY ALDRICH

FLORENCE COPPPER, INC.
FLORENCE, ARIZONA

PLAN VIEW OF MAXIMUM EXTENT OF MIGRATION DURING 48-HOUR AND 30-DAY INJECTION SCENARIOS WITHOUT HYDRAULIC CONTROL PUMPING

MARCH 2021

FIGURE 12



LEGEND

- NEW IRRIGATION WELL
- EXISTING WELL
- ISCR WELL FIELD
- EXTENT OF SOLUTE MIGRATION WITHOUT WELLS N1, N2, BIA-9R AND WW4 PUMPING
- EXTENT OF SOLUTE MIGRATION WITH WELLS N1, N2, BIA-9R AND WW4 PUMPING

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. AERIAL IMAGERY SOURCE: ESRI

N

0 800 1,600
SCALE IN FEET

HALEY ALDRICH

FLORENCE COPPER, INC.
FLORENCE, ARIZONA

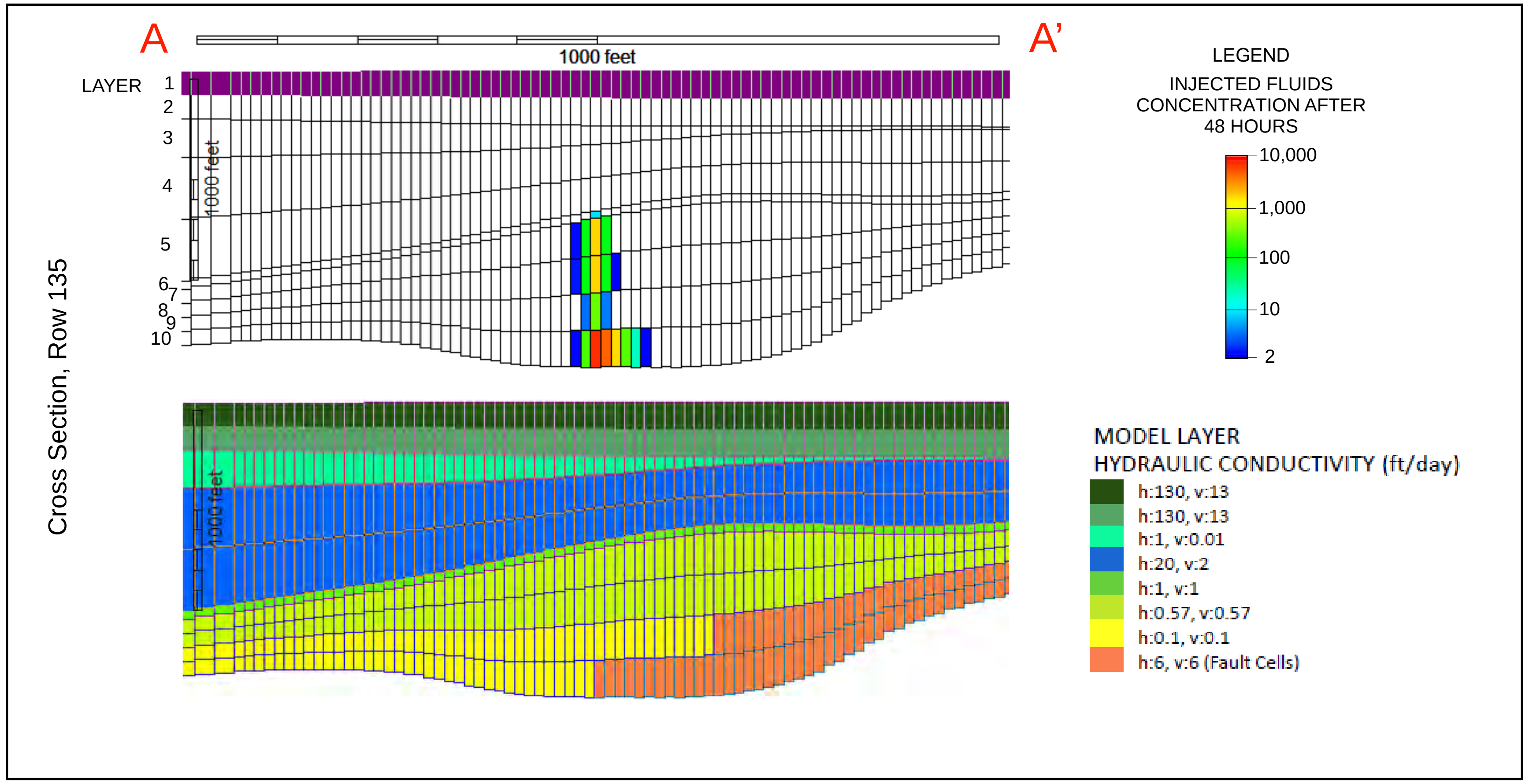
DISCHARGE IMPACT AREA 30 YEARS AFTER CLOSURE WITH NEW IRRIGATION WELLS PUMPING

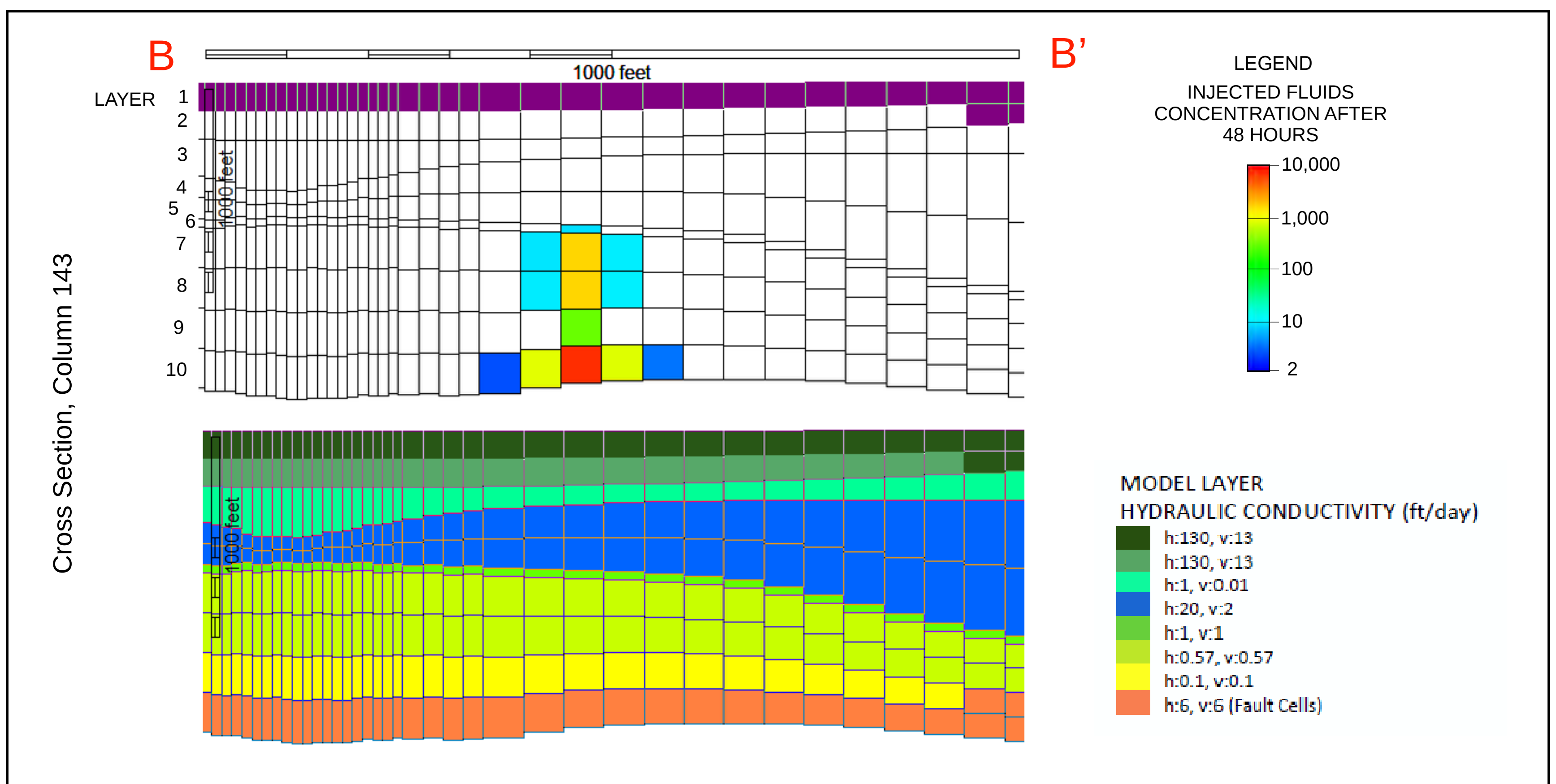
MARCH 2021

FIGURE 13

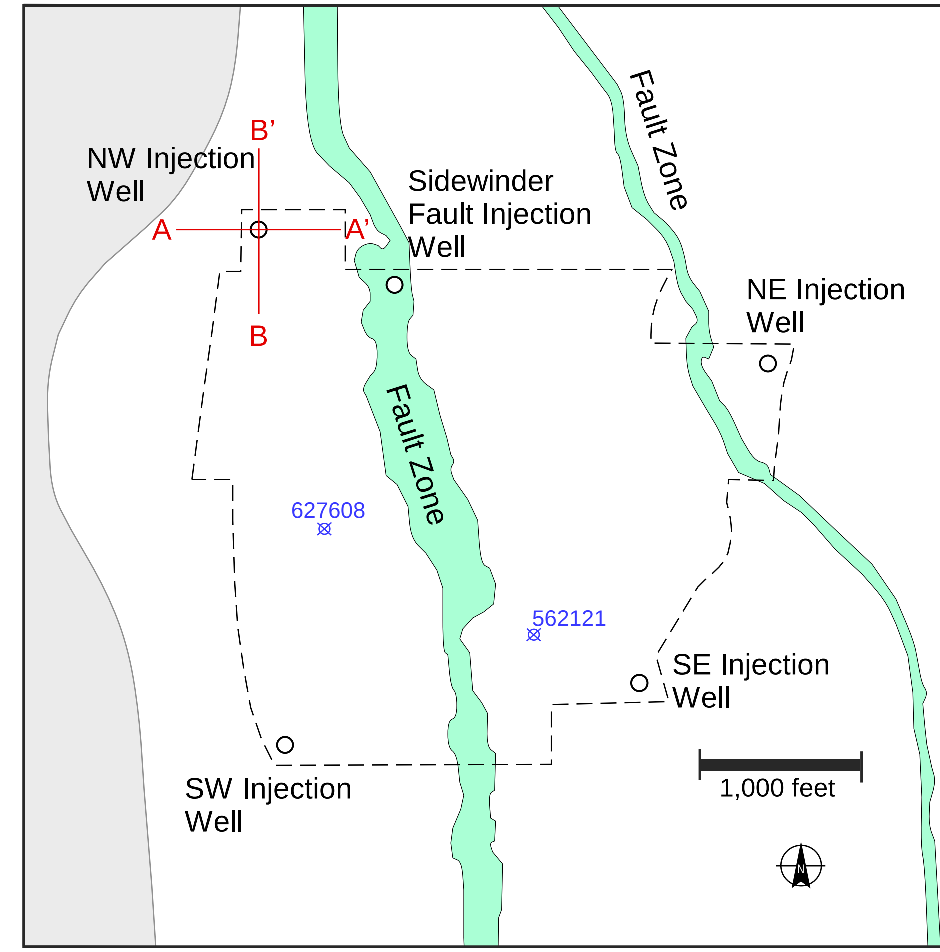
EXHIBIT A-8-1

Figures A-4 through A-13
of the 4 October 2019 UIC Permit Application





FAULT LOCATION MAP

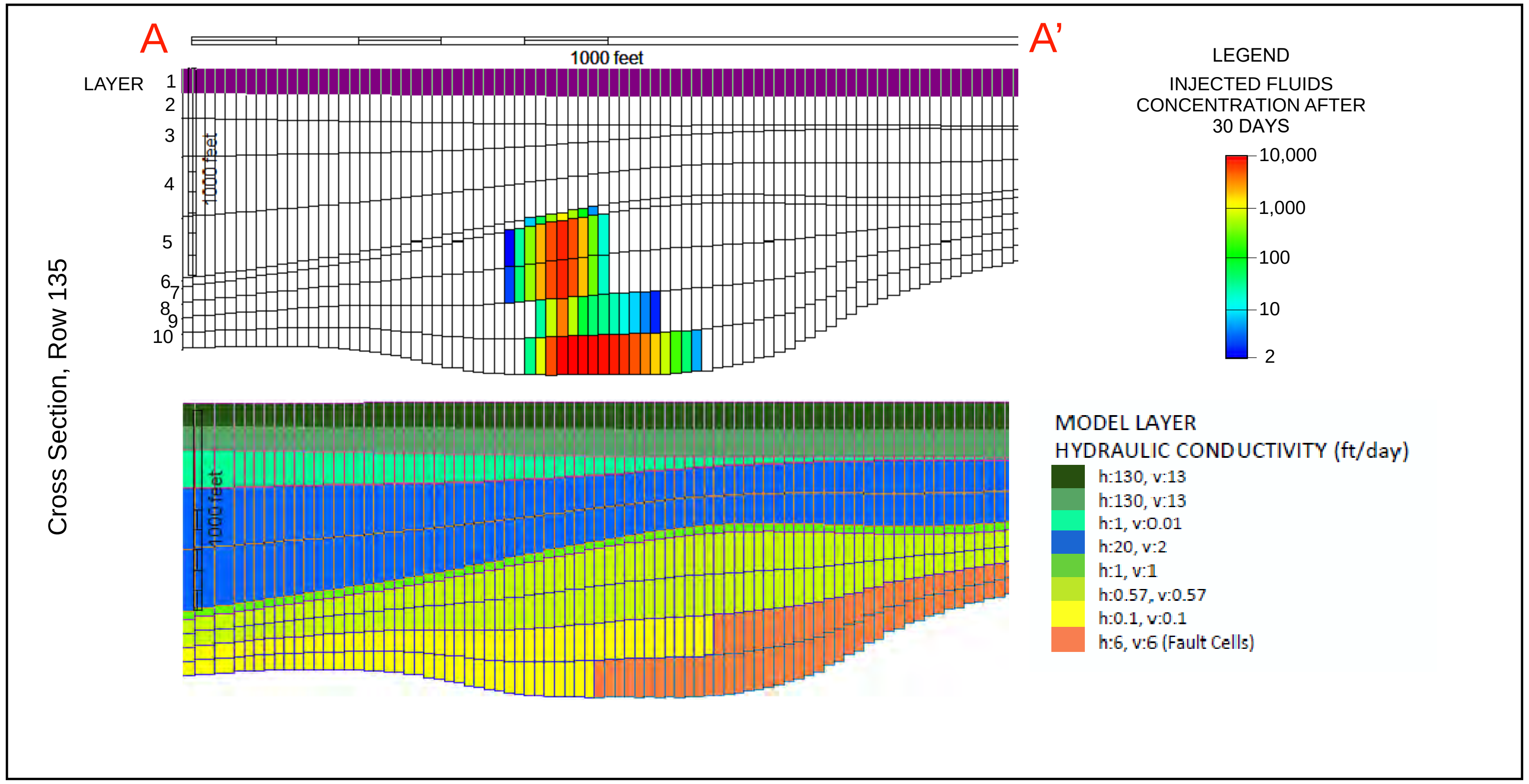


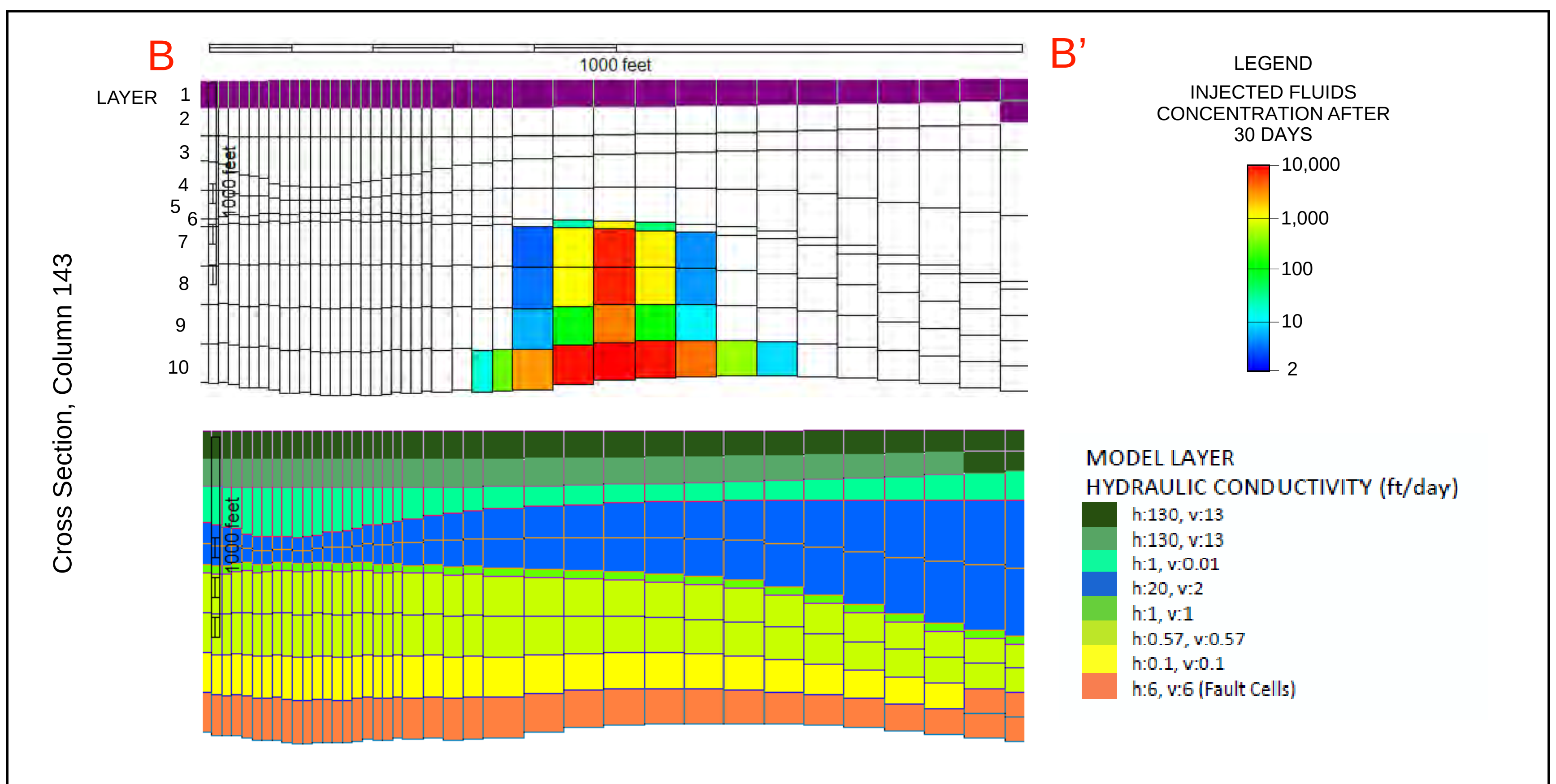
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

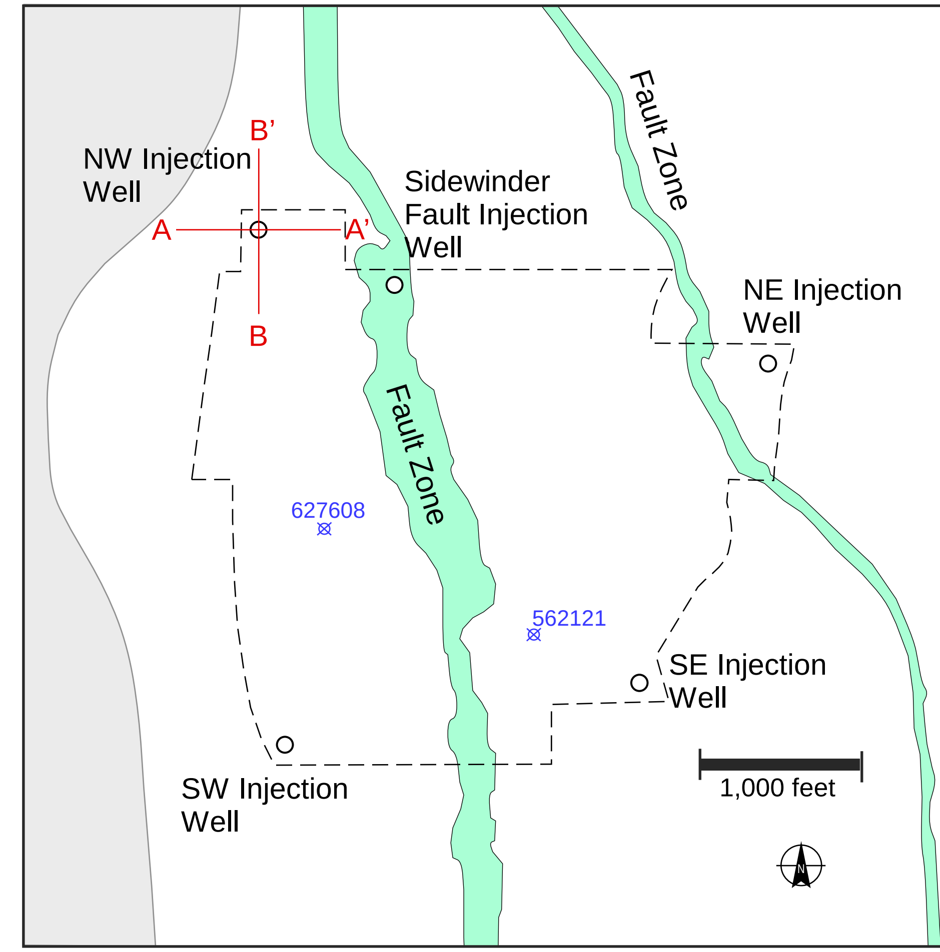
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-4





FAULT LOCATION MAP

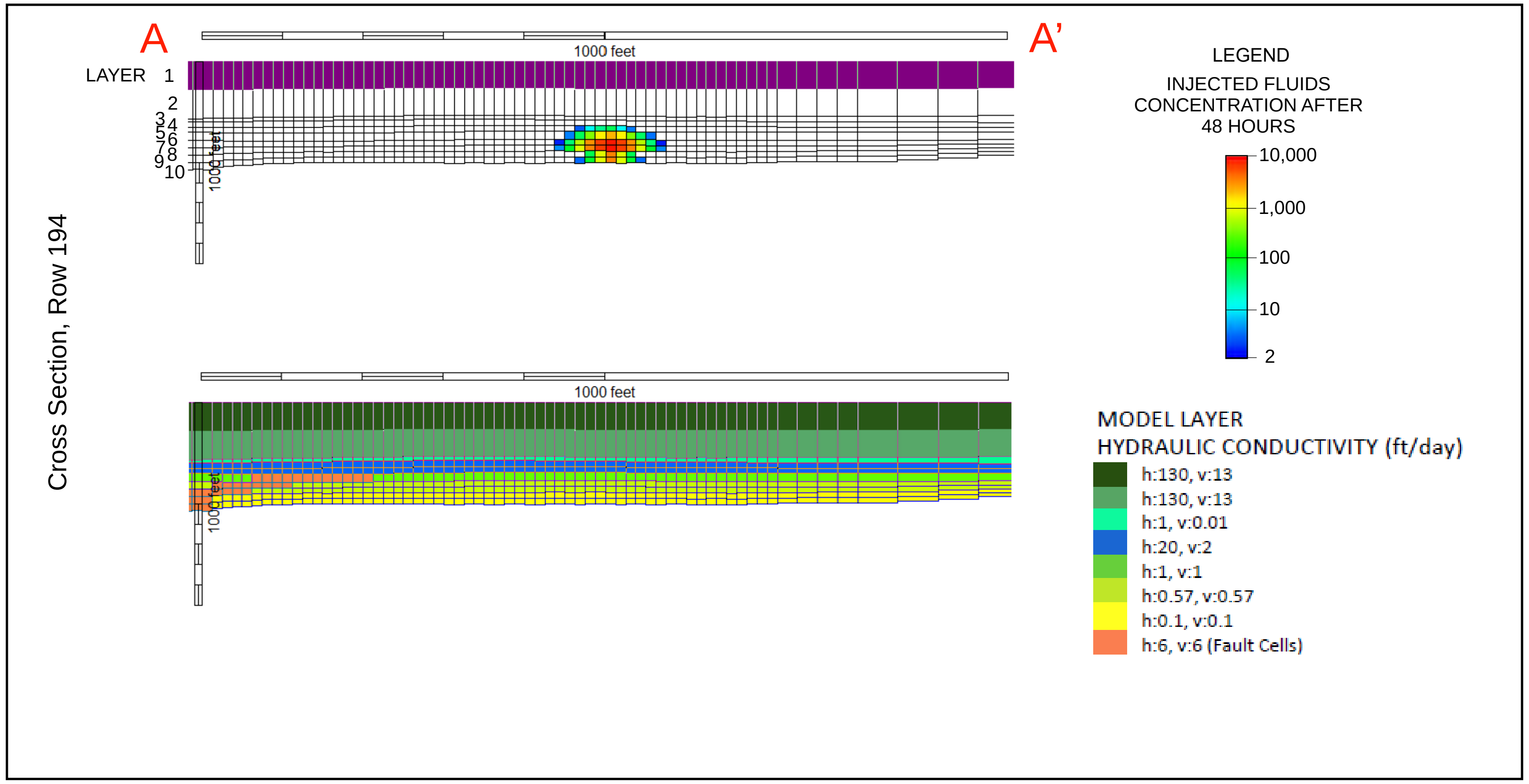


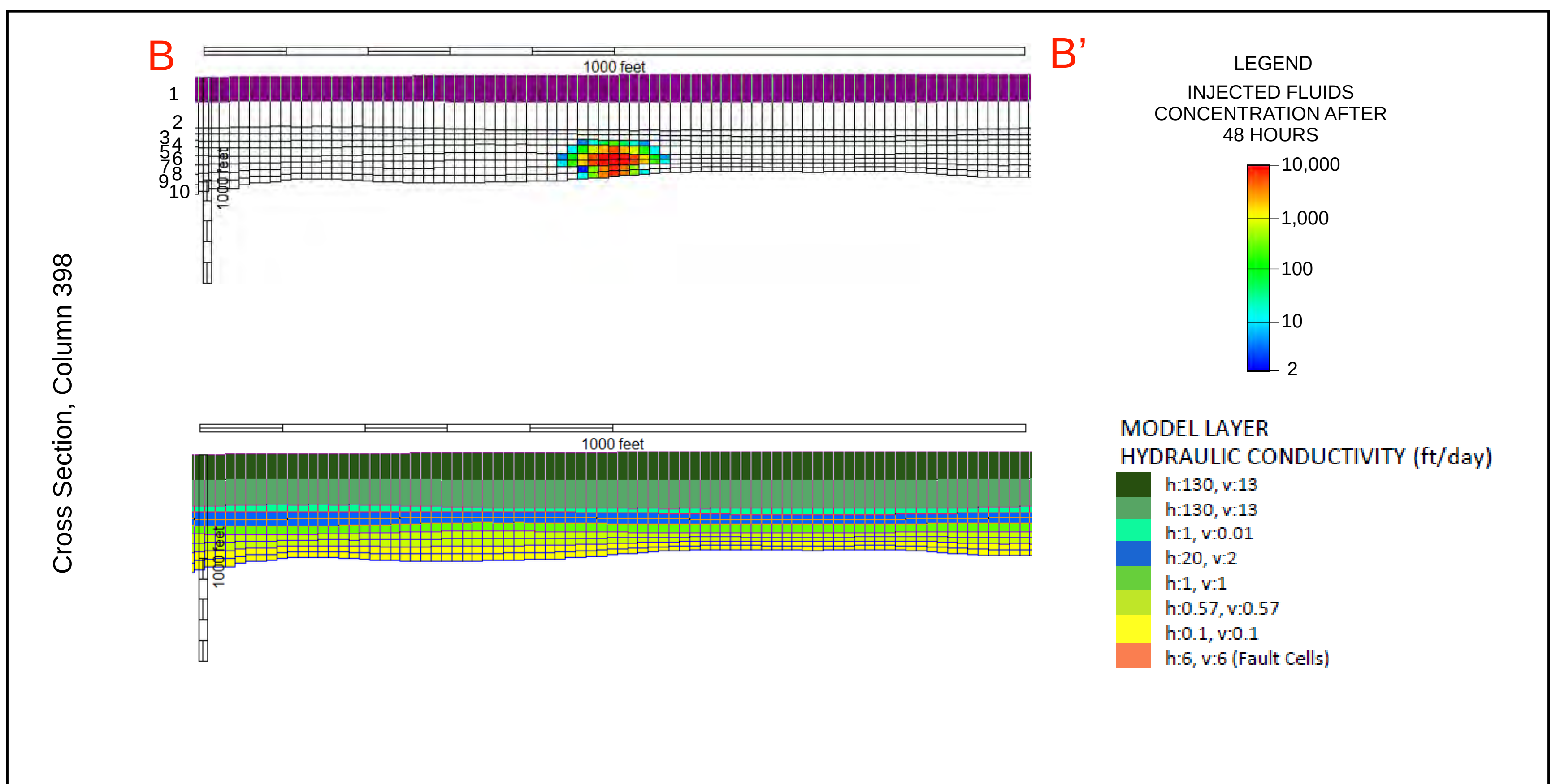
HALEY ALDRICH

CROSS SECTIONS
NW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

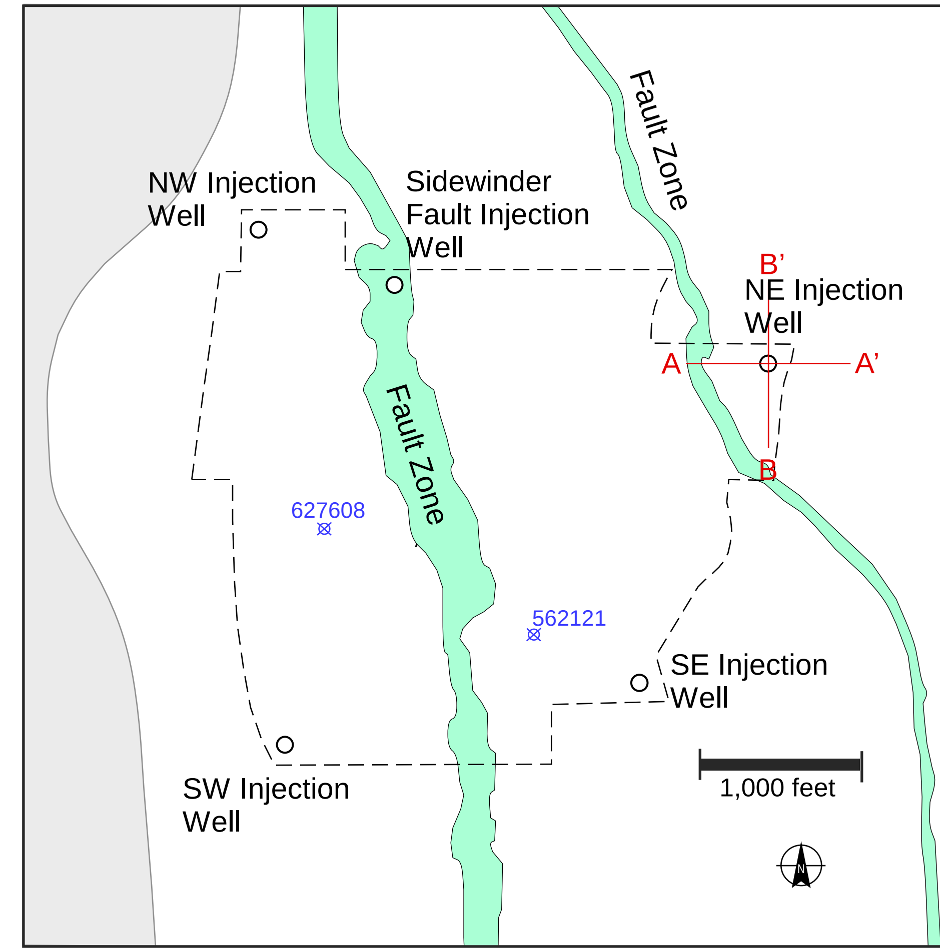
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-5





FAULT LOCATION MAP

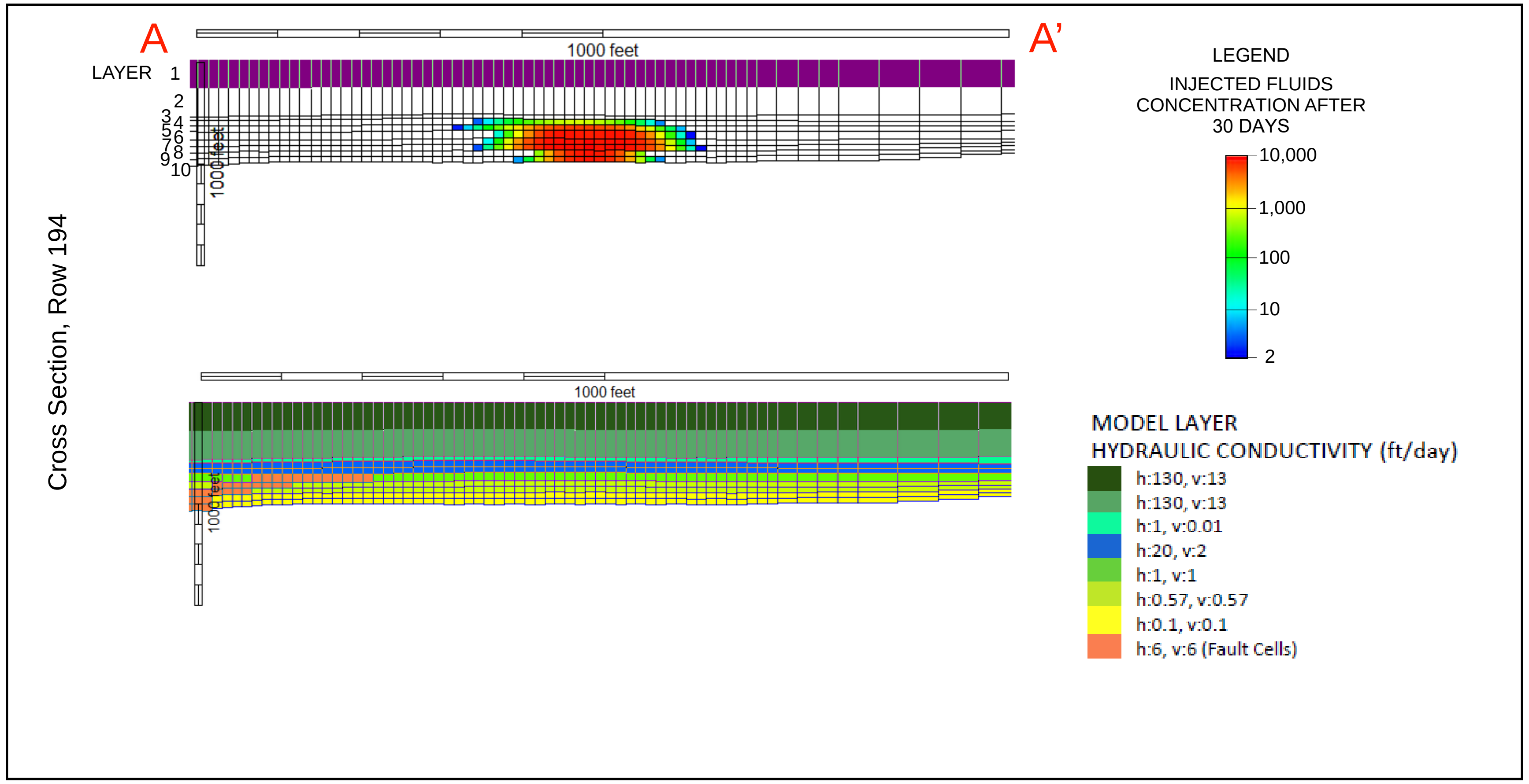


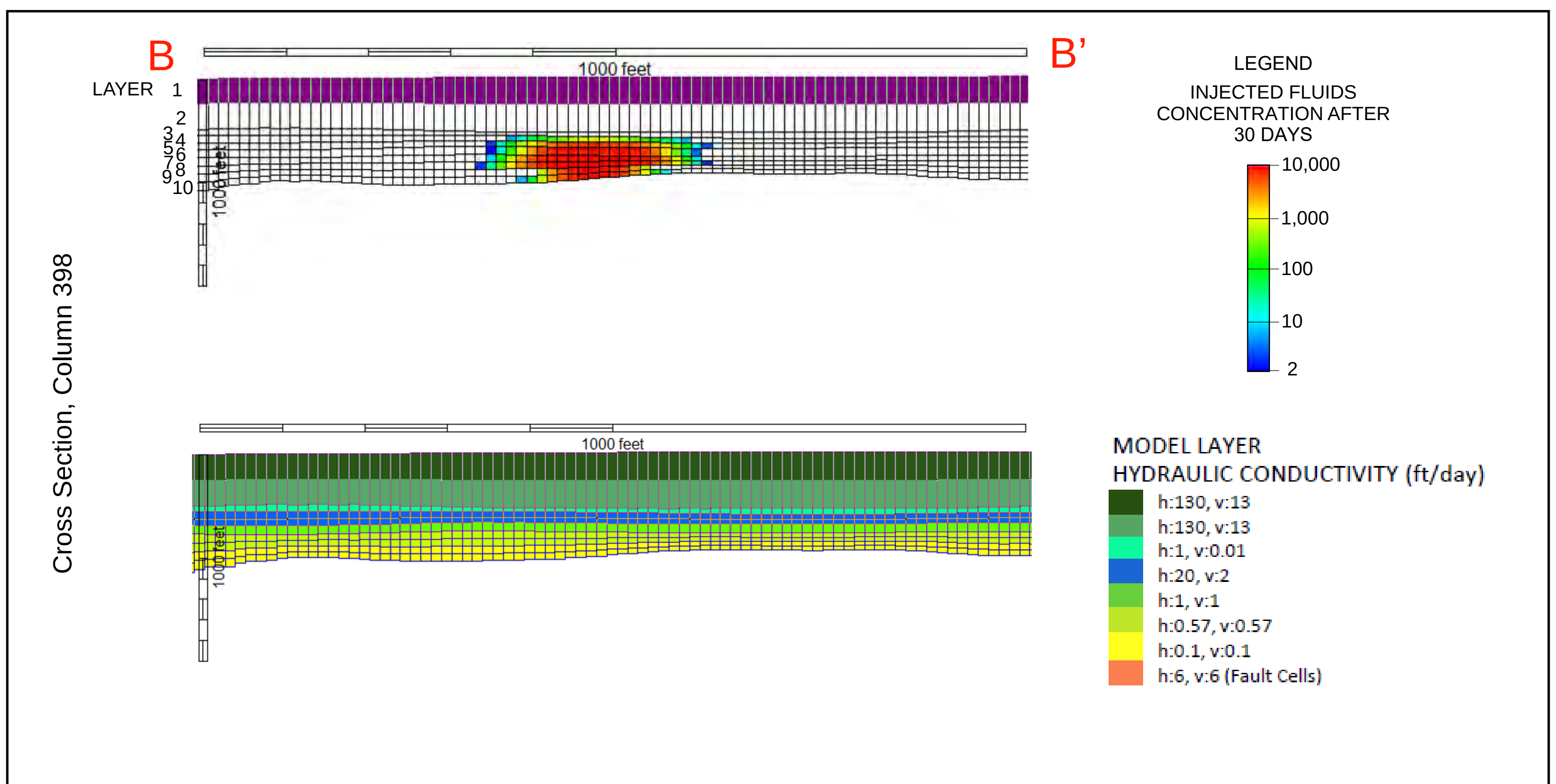
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

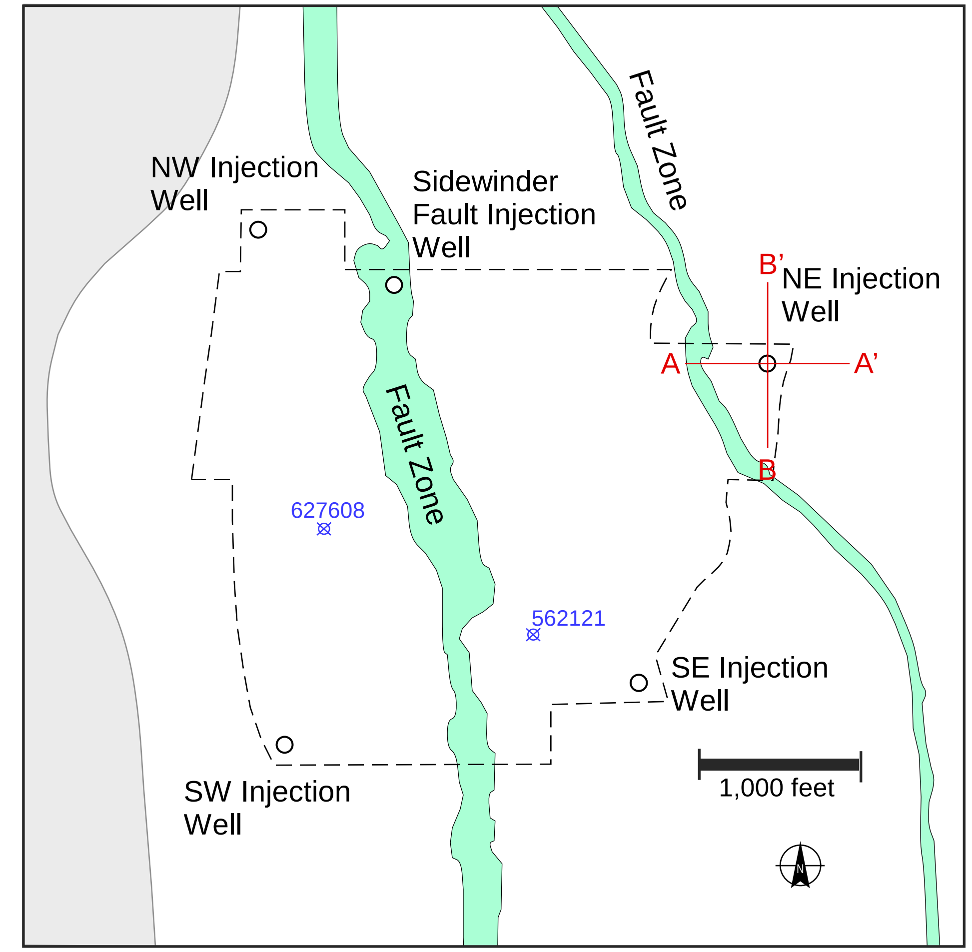
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-6





FAULT LOCATION MAP

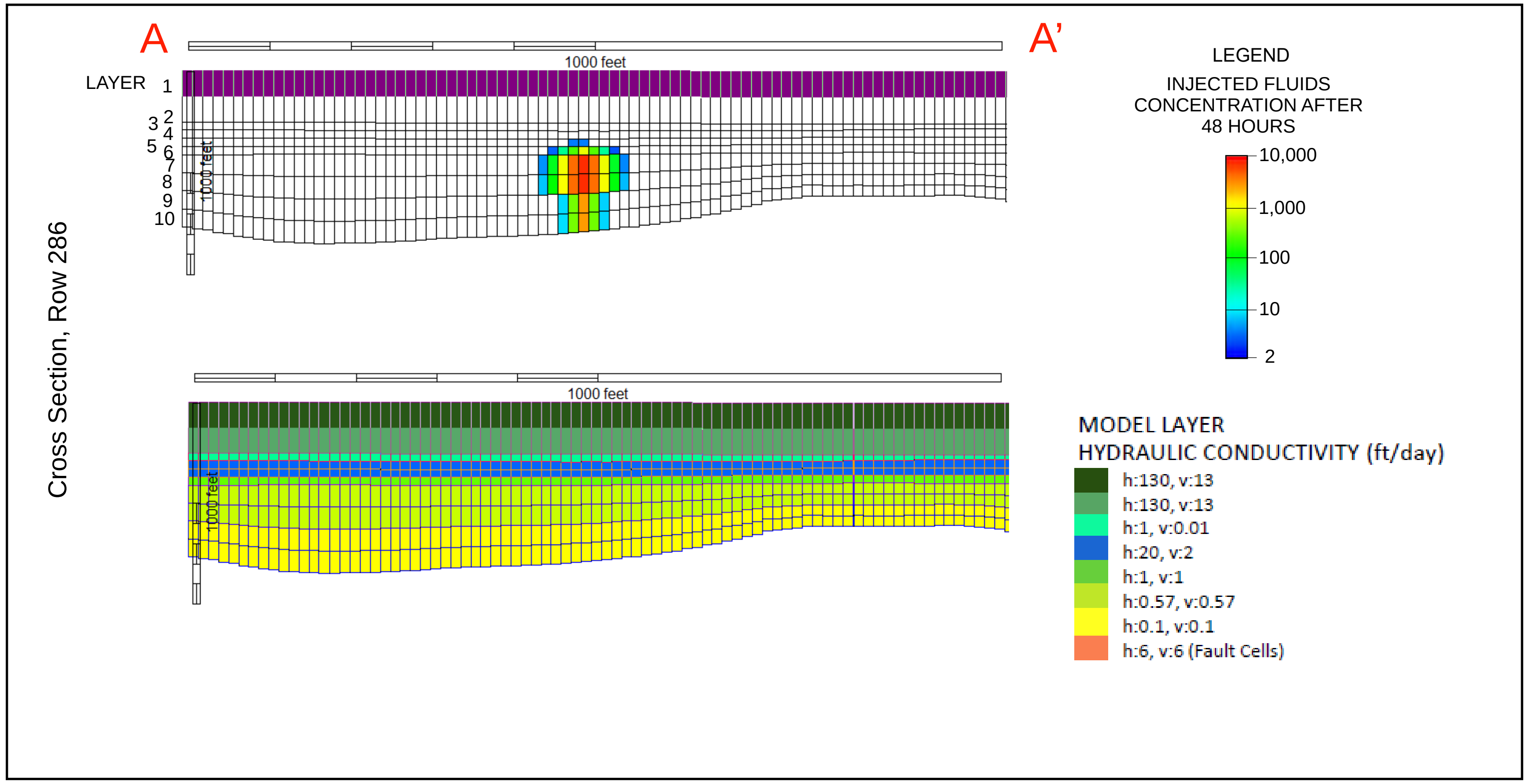


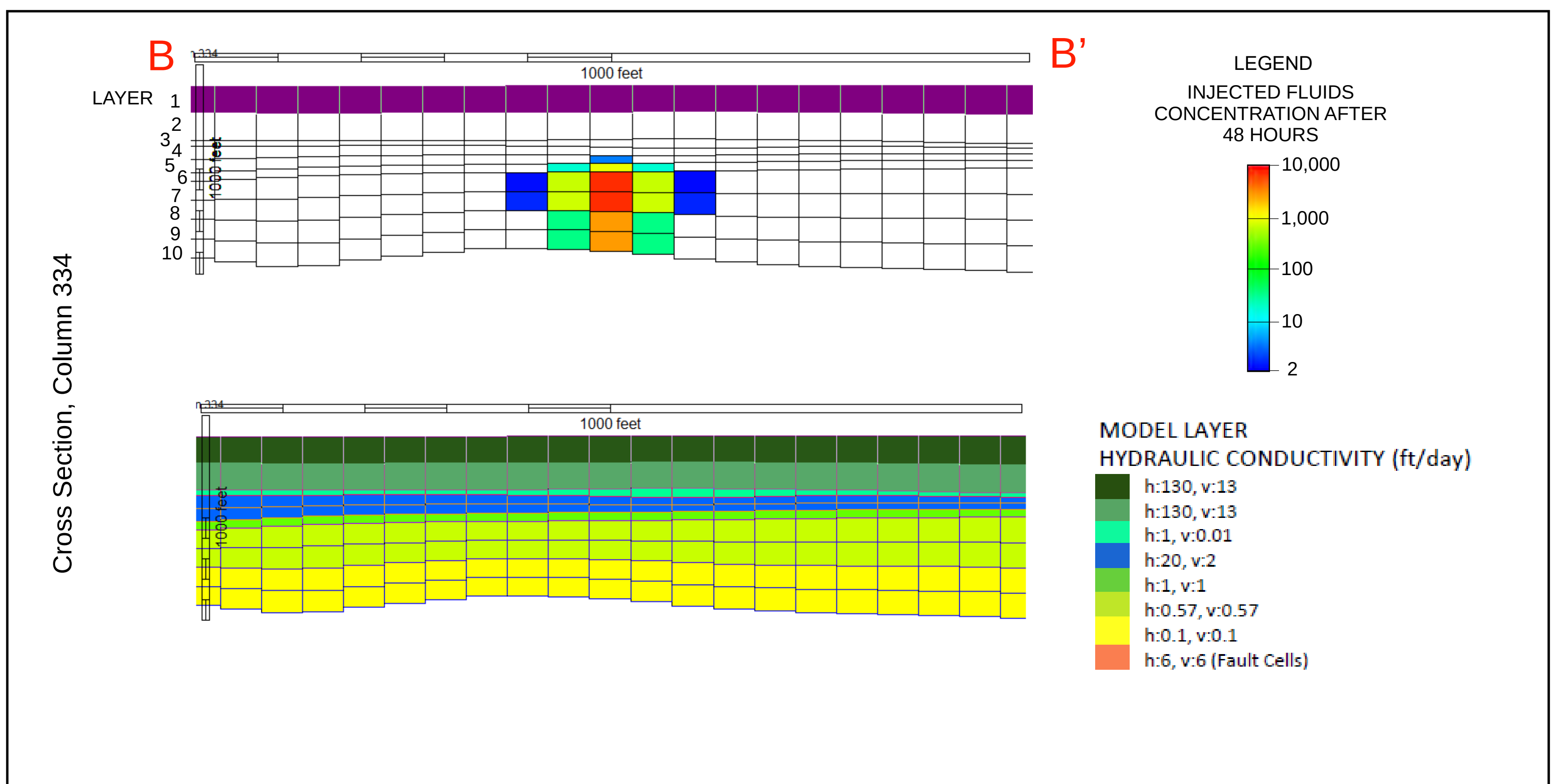
HALEY ALDRICH

CROSS SECTIONS
NE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

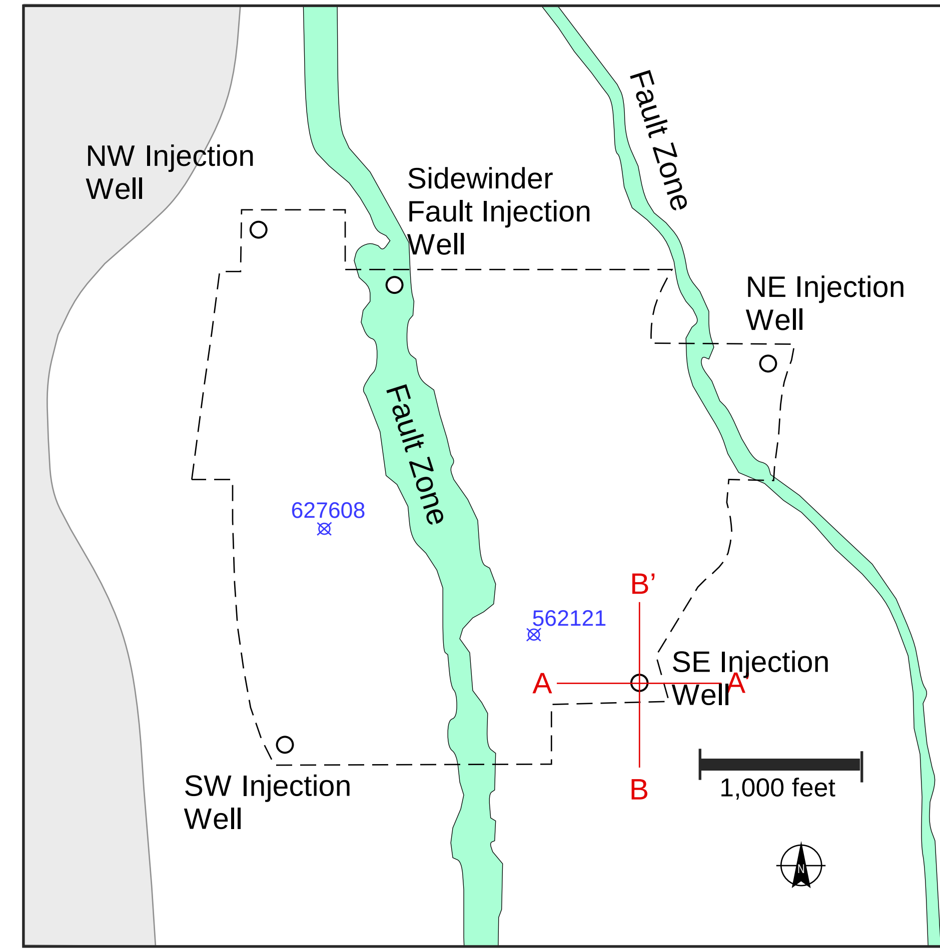
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-7





FAULT LOCATION MAP

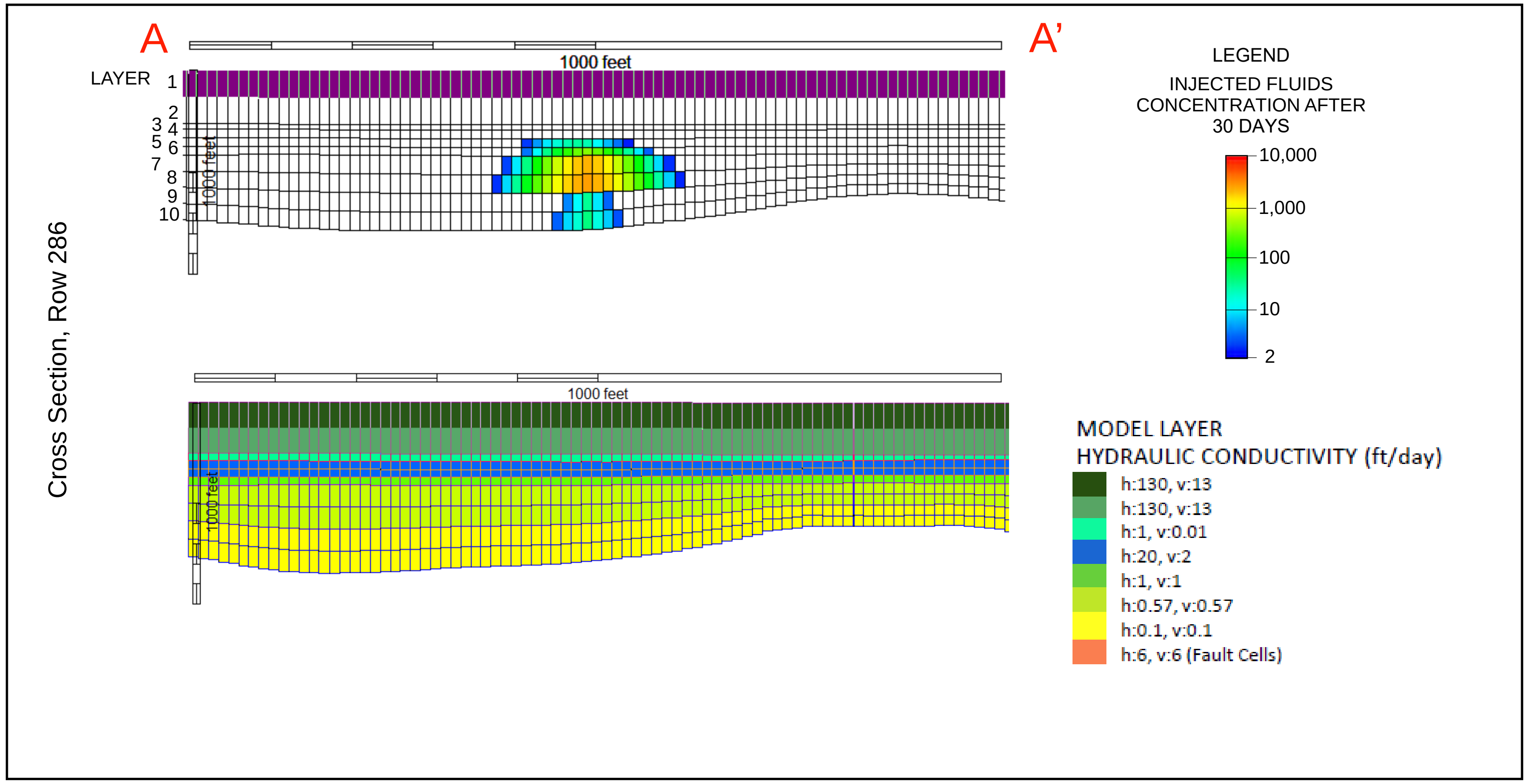


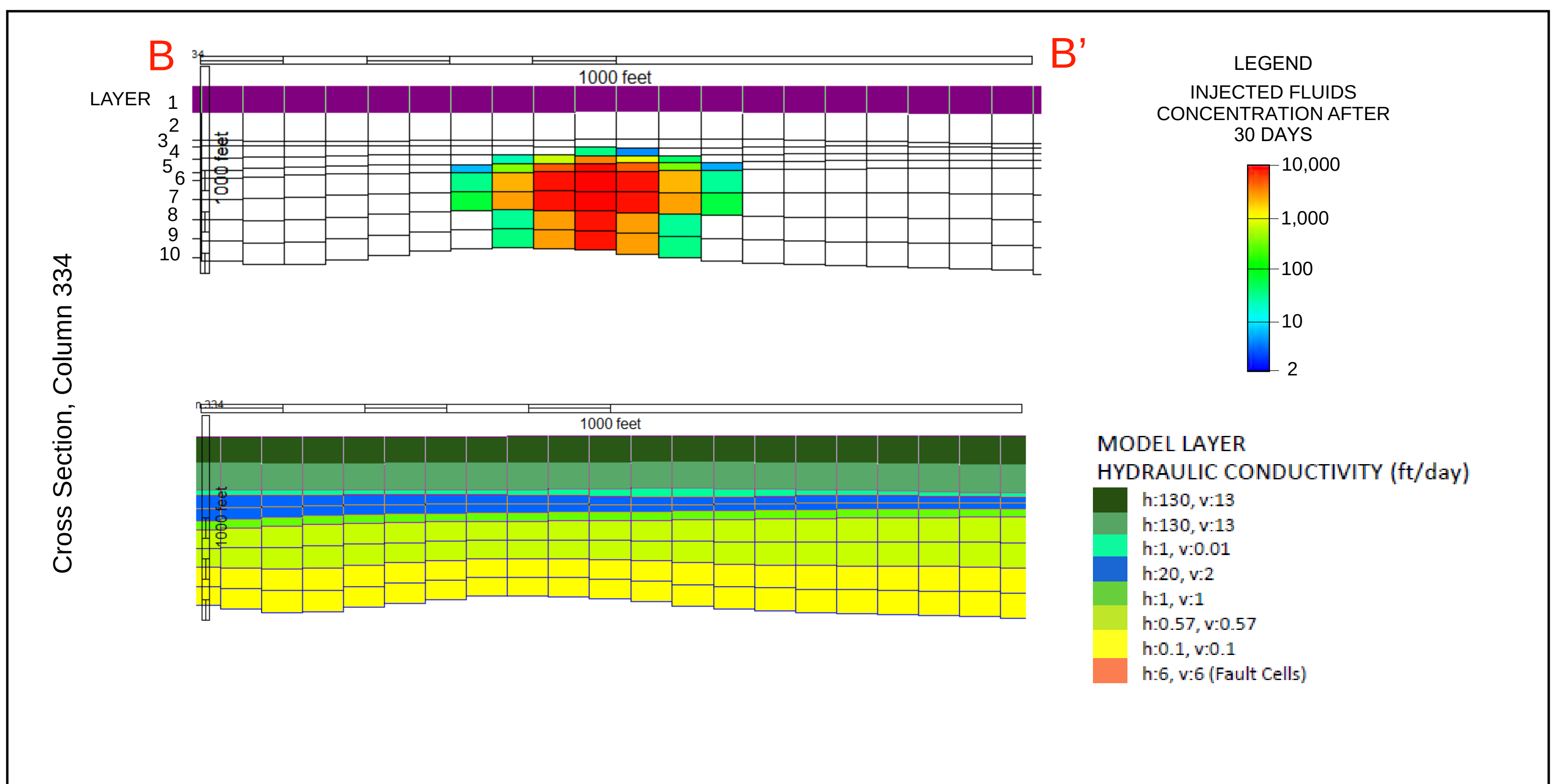
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

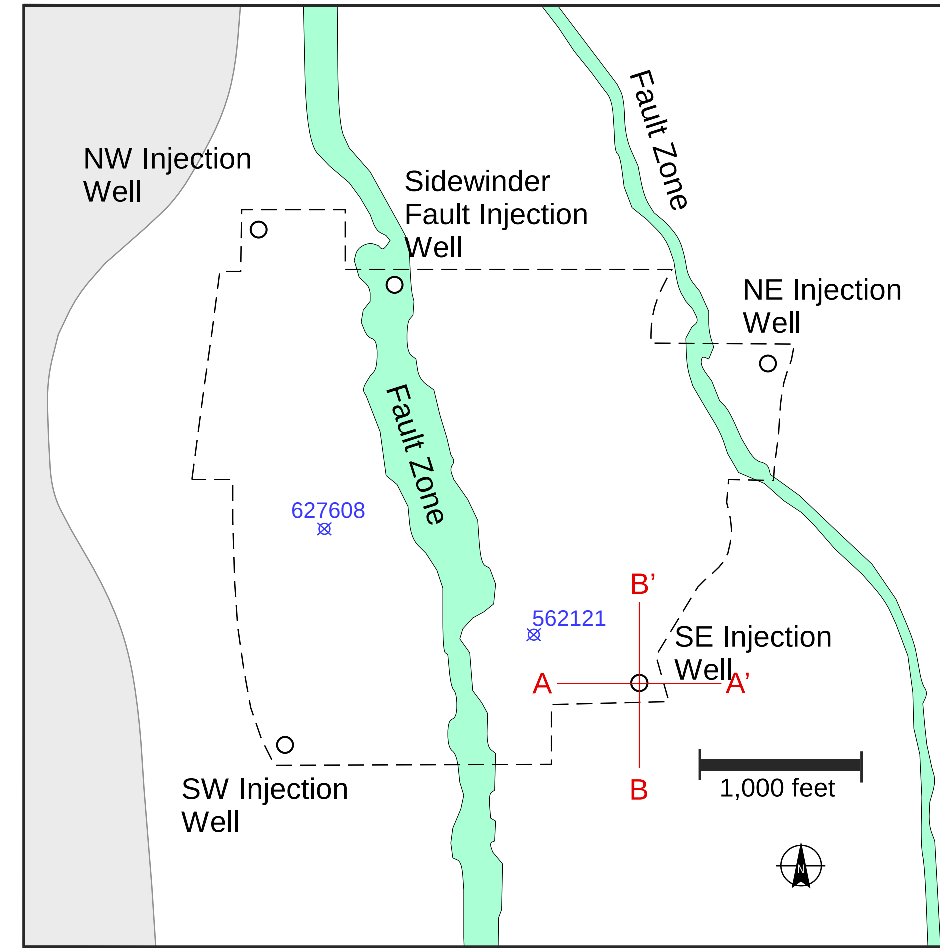
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-8





FAULT LOCATION MAP

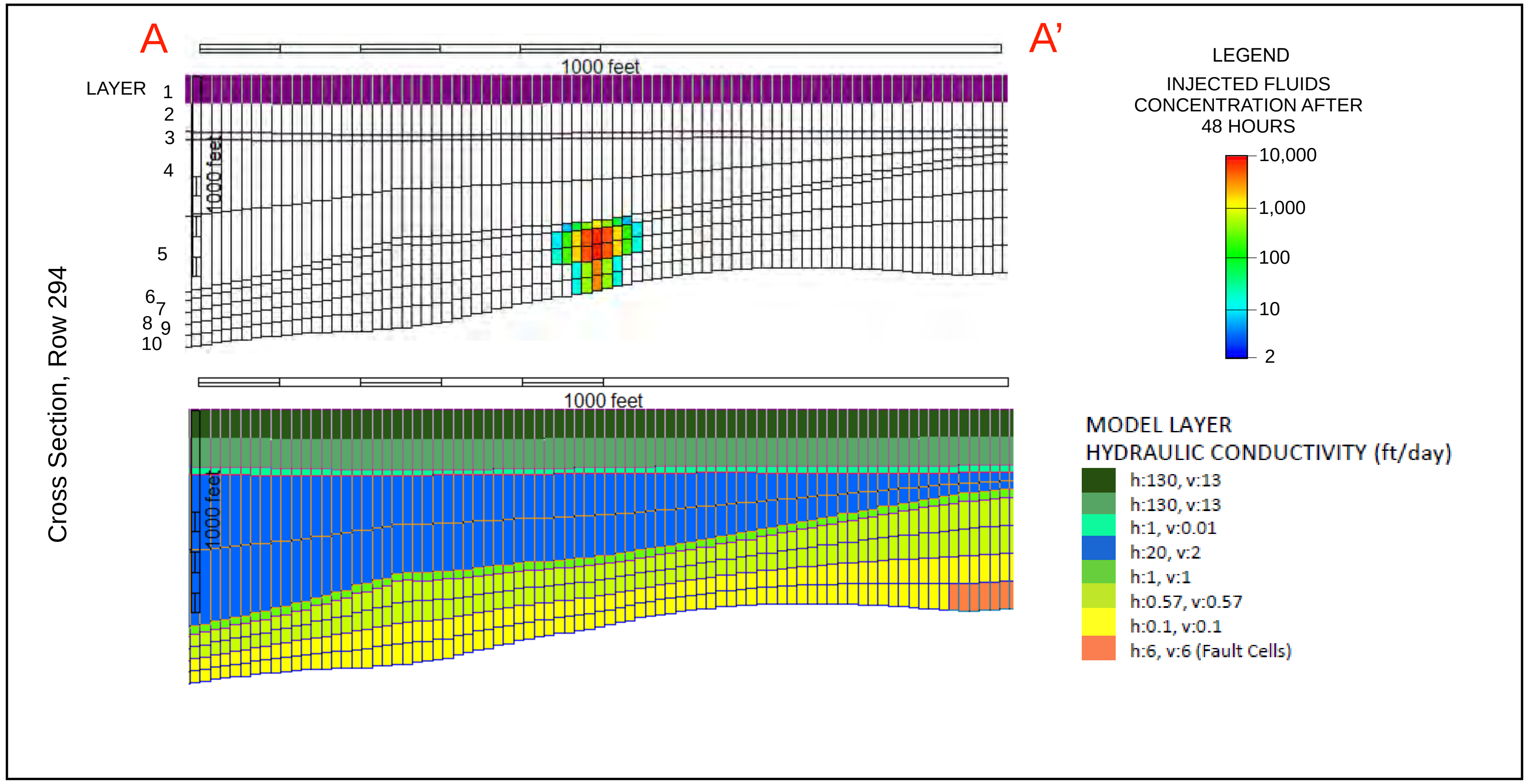


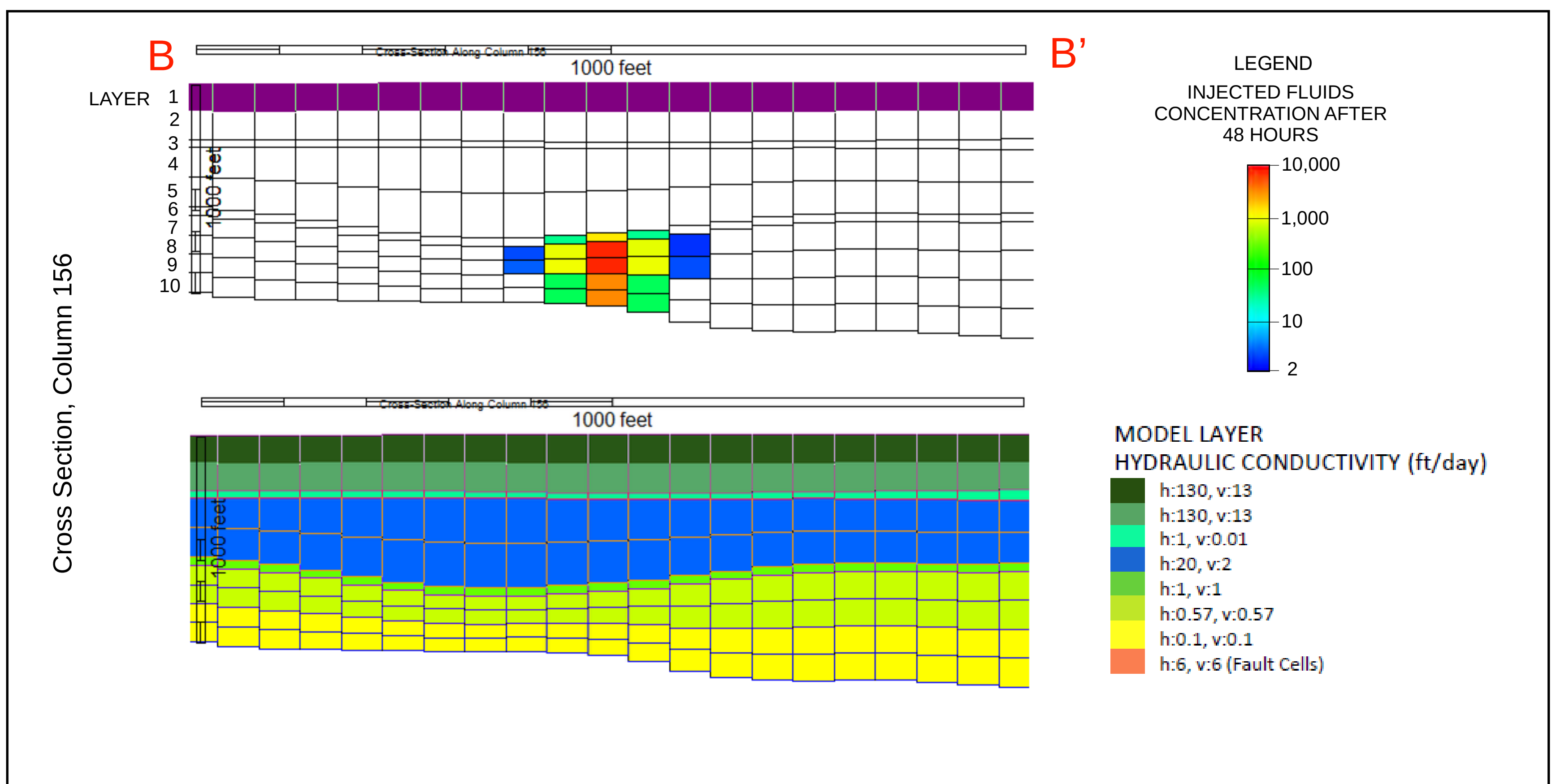
HALEY ALDRICH

CROSS SECTIONS
SE INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

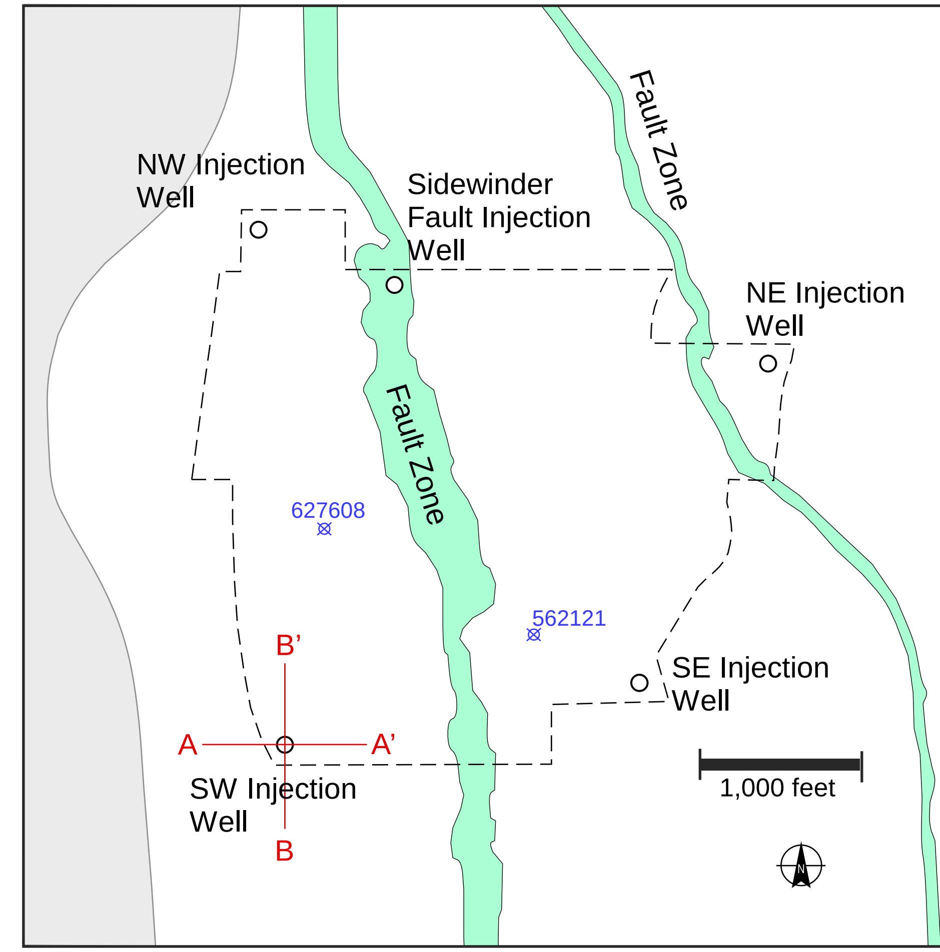
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-9





FAULT LOCATION MAP

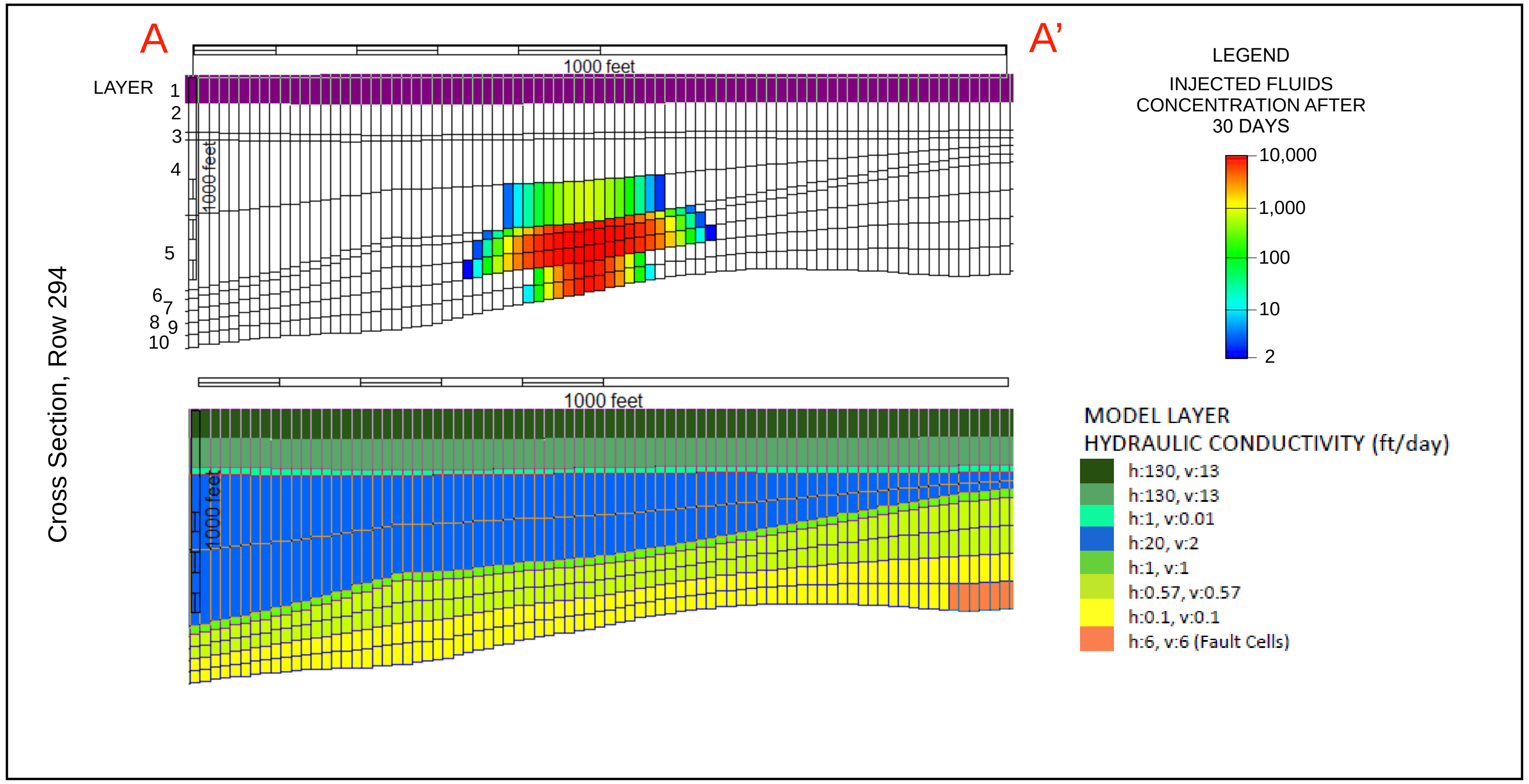


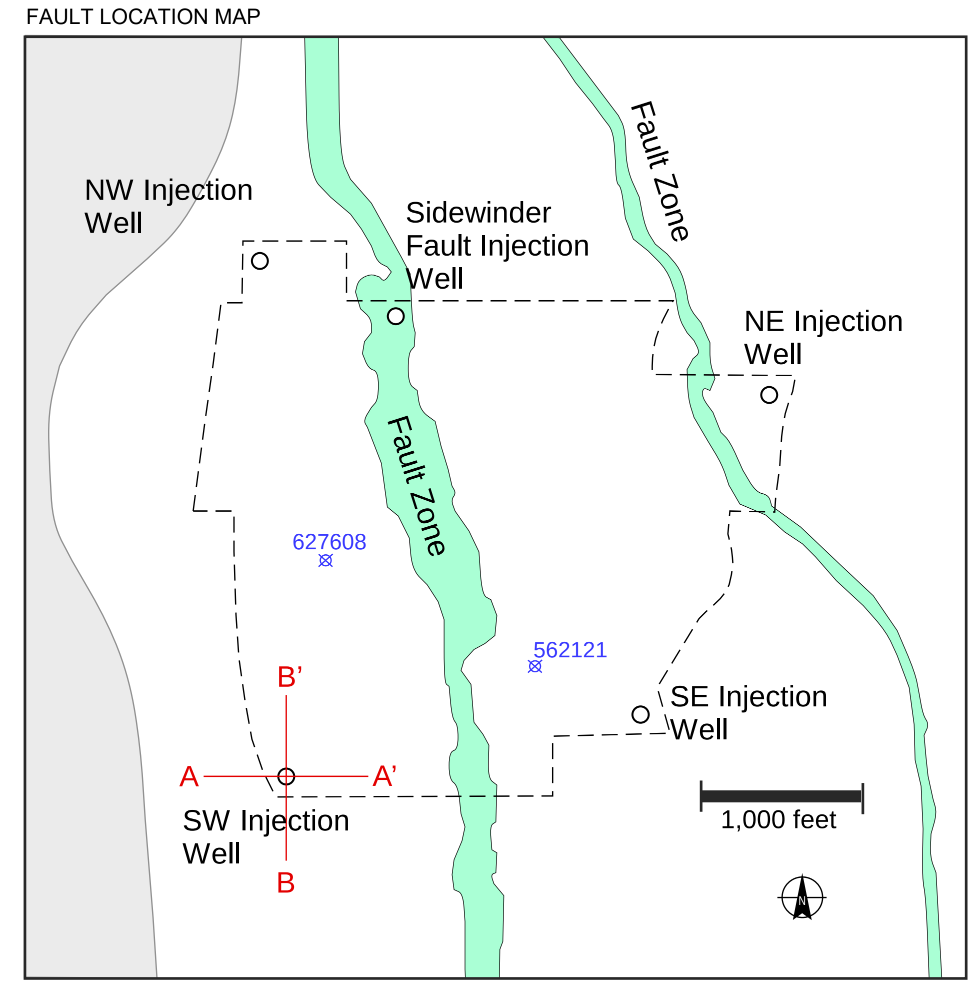
HALEY ALDRICH

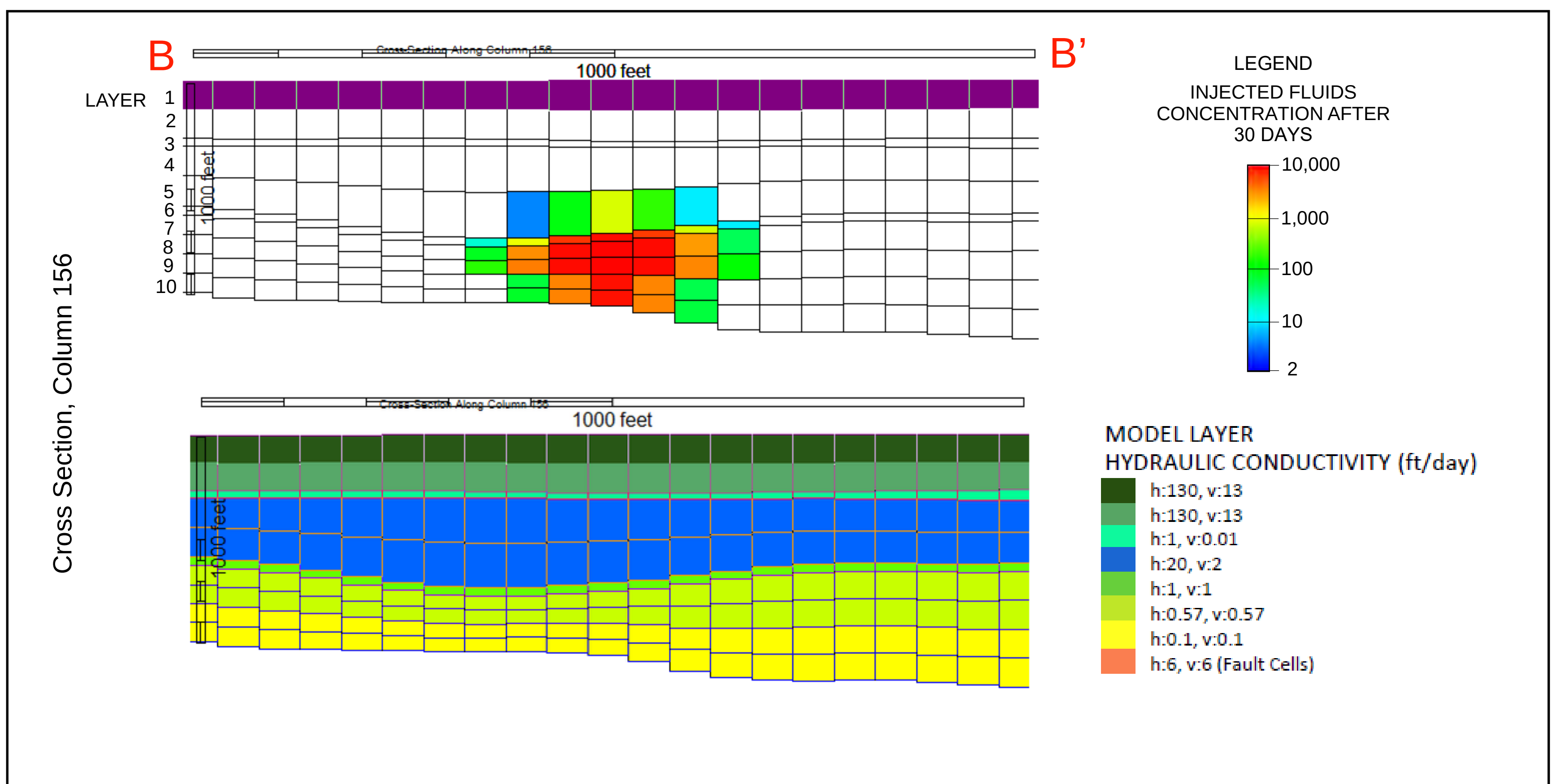
CROSS SECTIONS
SW INJECTION WELL, 48 HOURS
INJECTION WITH NO EXTRACTION

FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-10





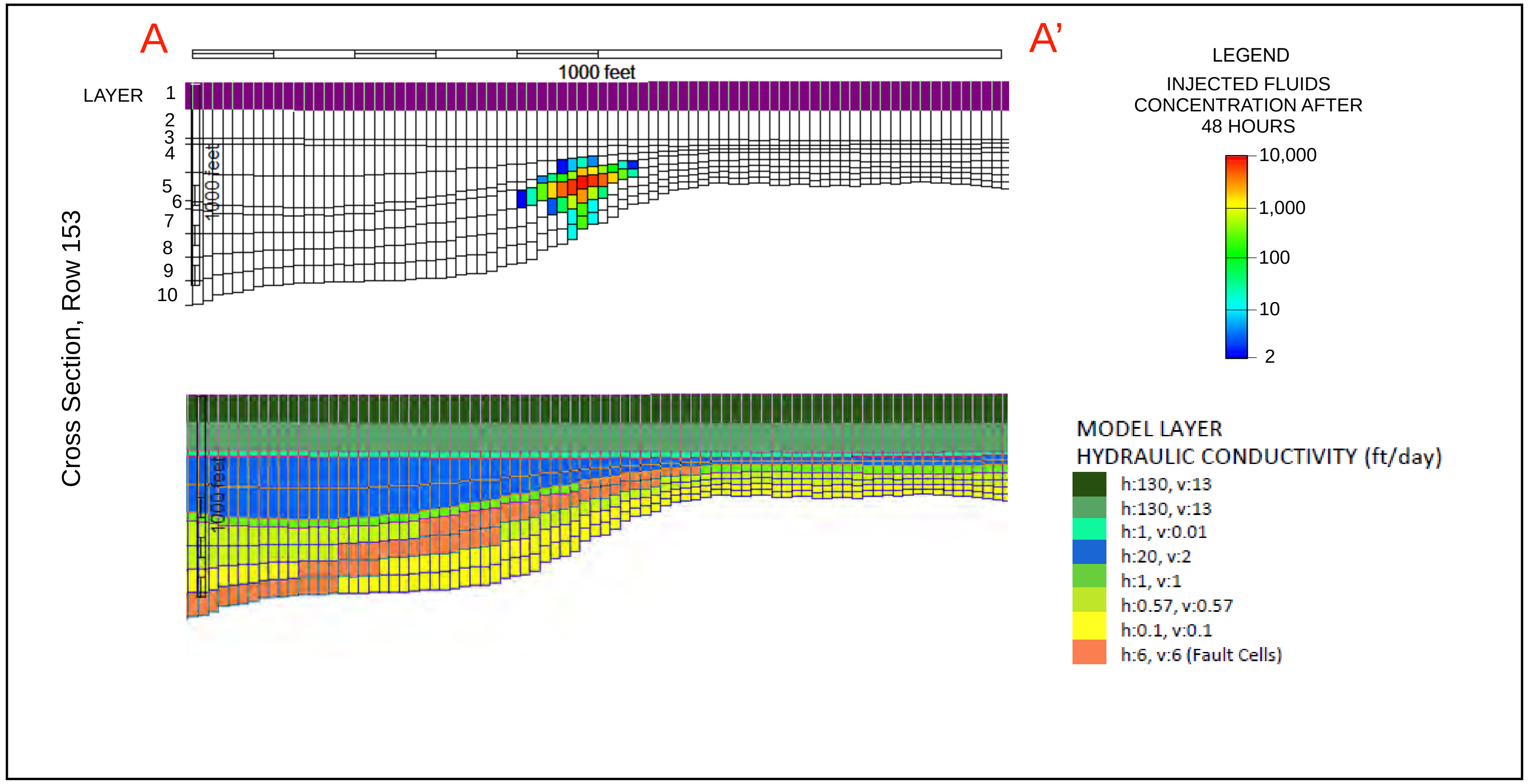


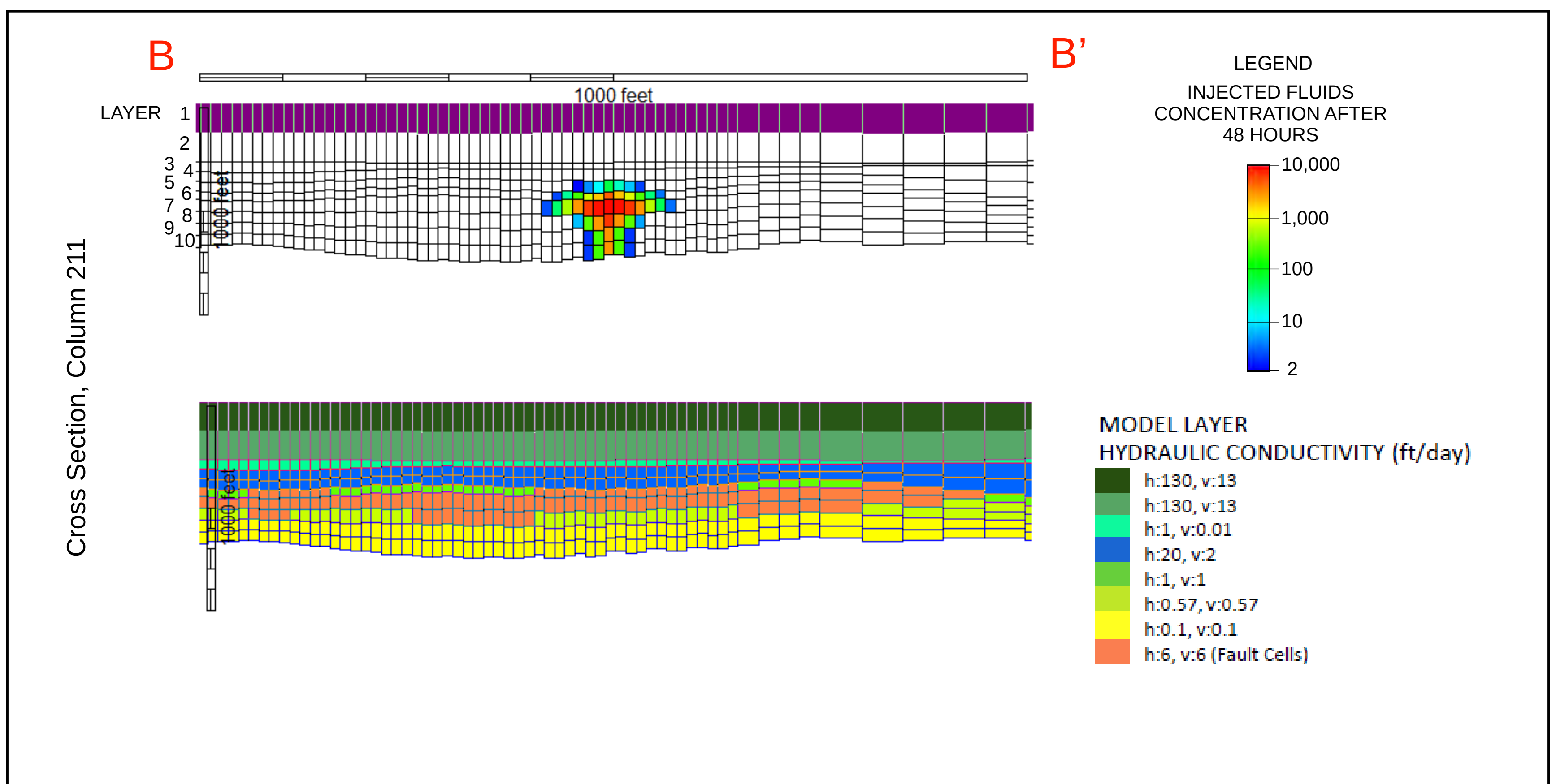
HALEY ALDRICH

CROSS SECTIONS
SW INJECTION WELL, 30 DAYS
INJECTION WITH NO EXTRACTION

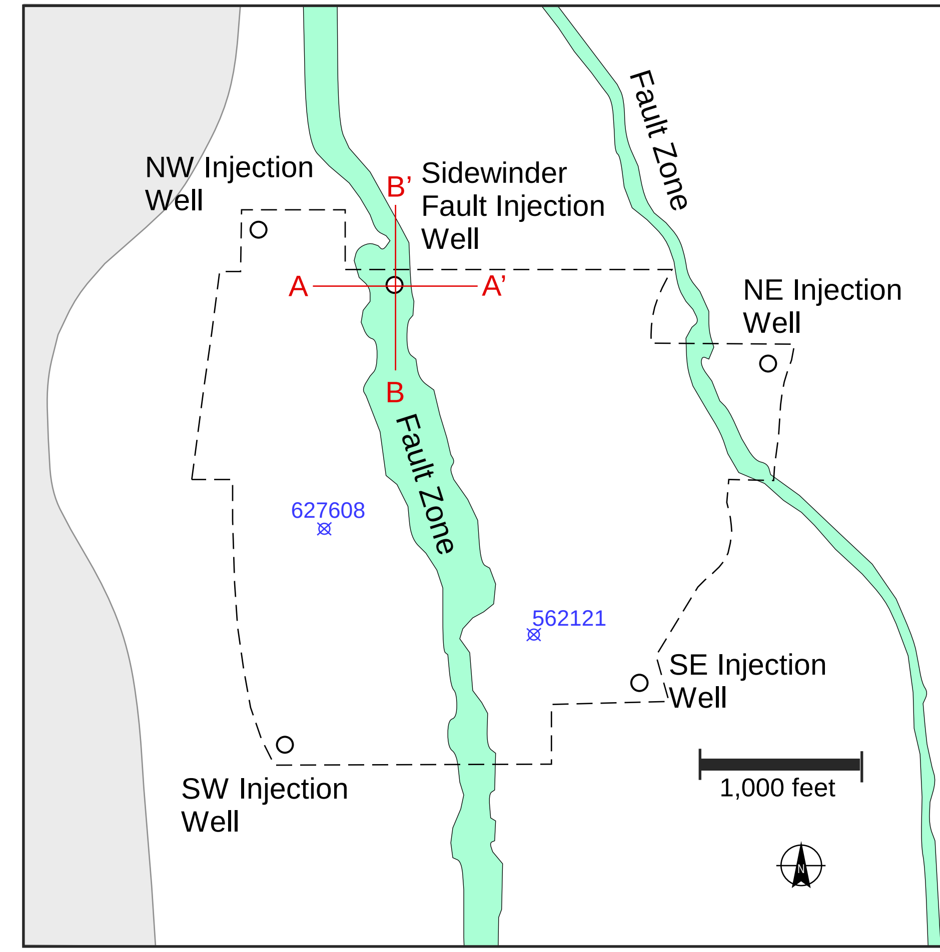
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-11





FAULT LOCATION MAP

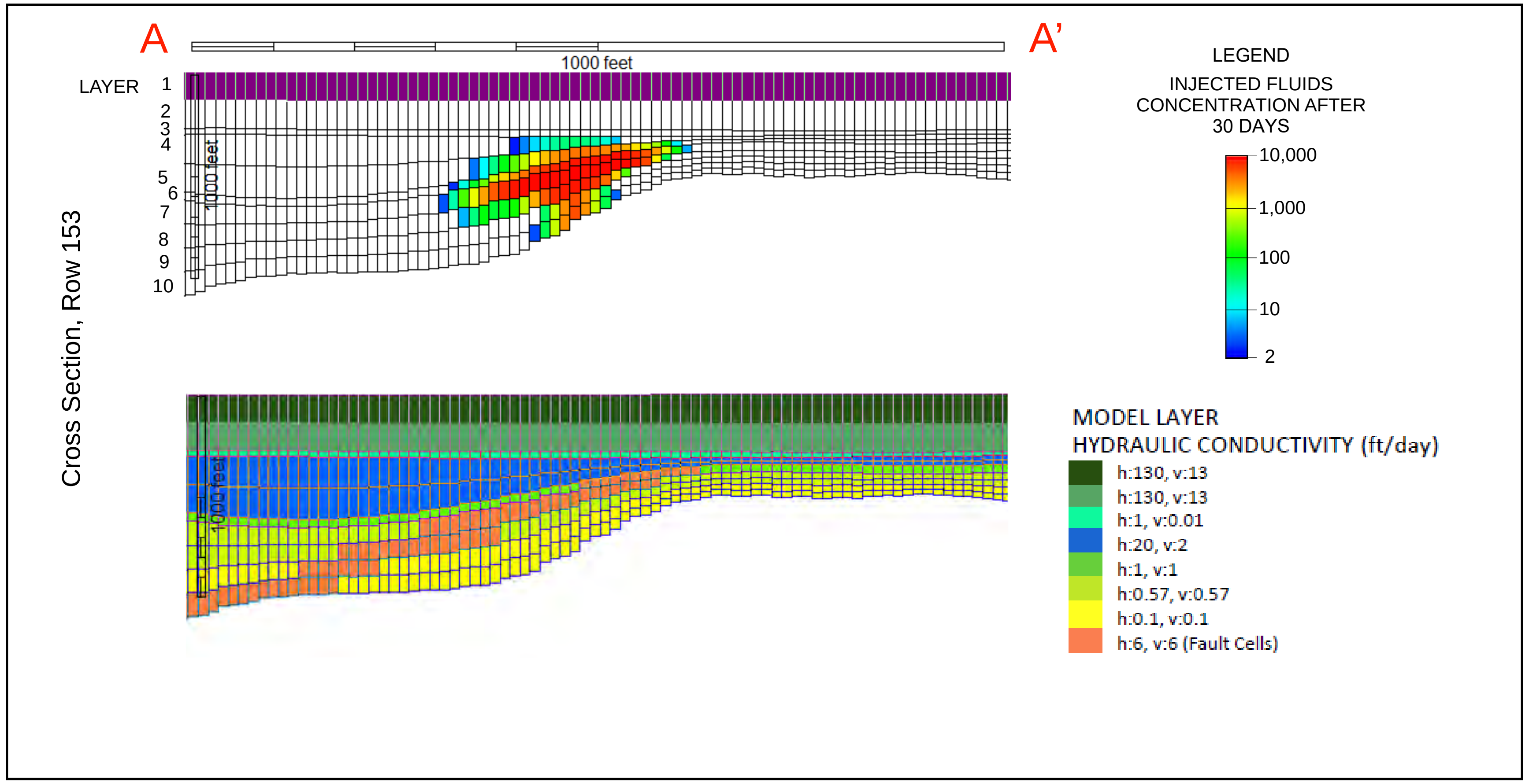


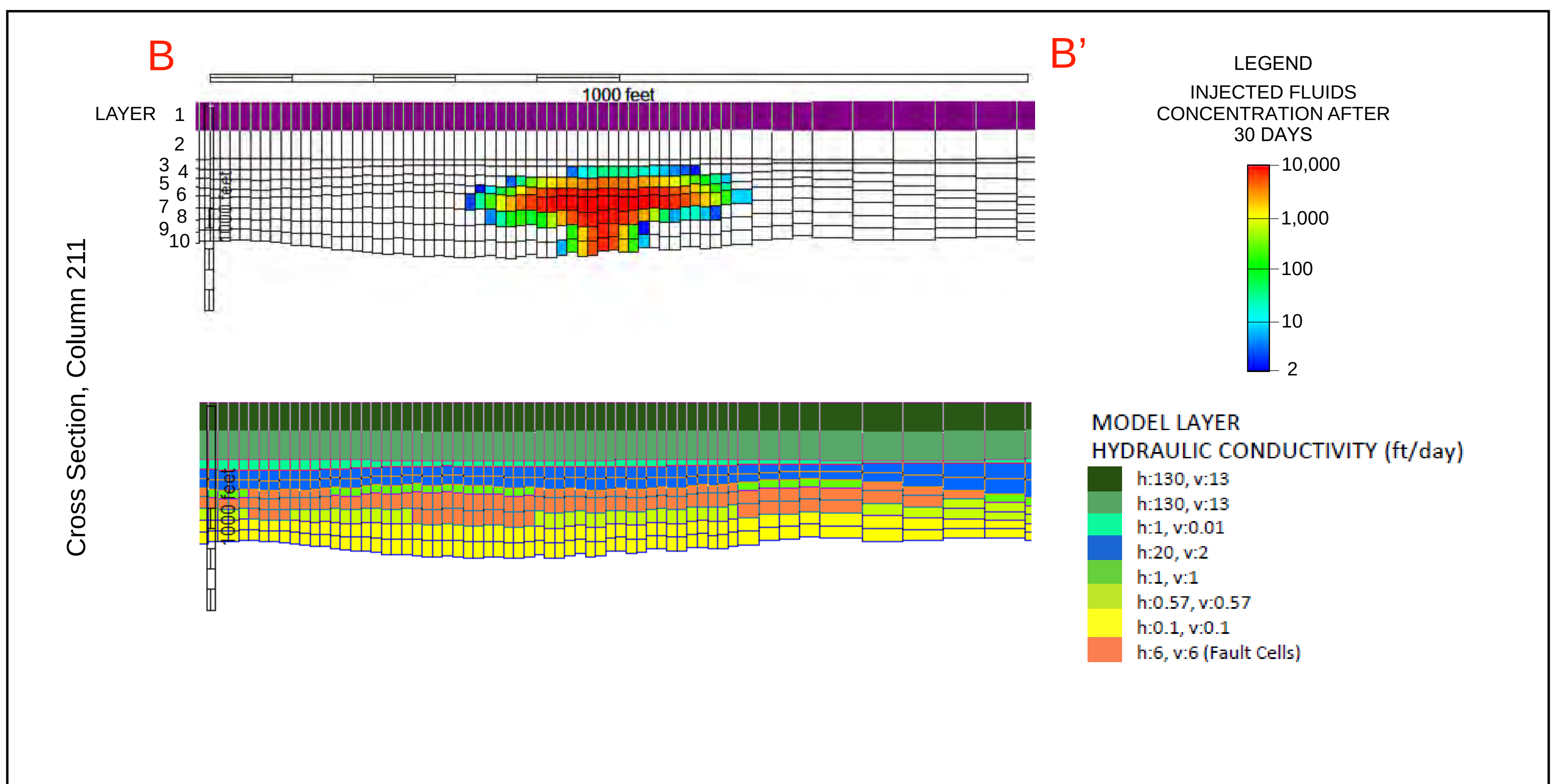
HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 48 HOUR INJECTION WITH NO EXTRACTION

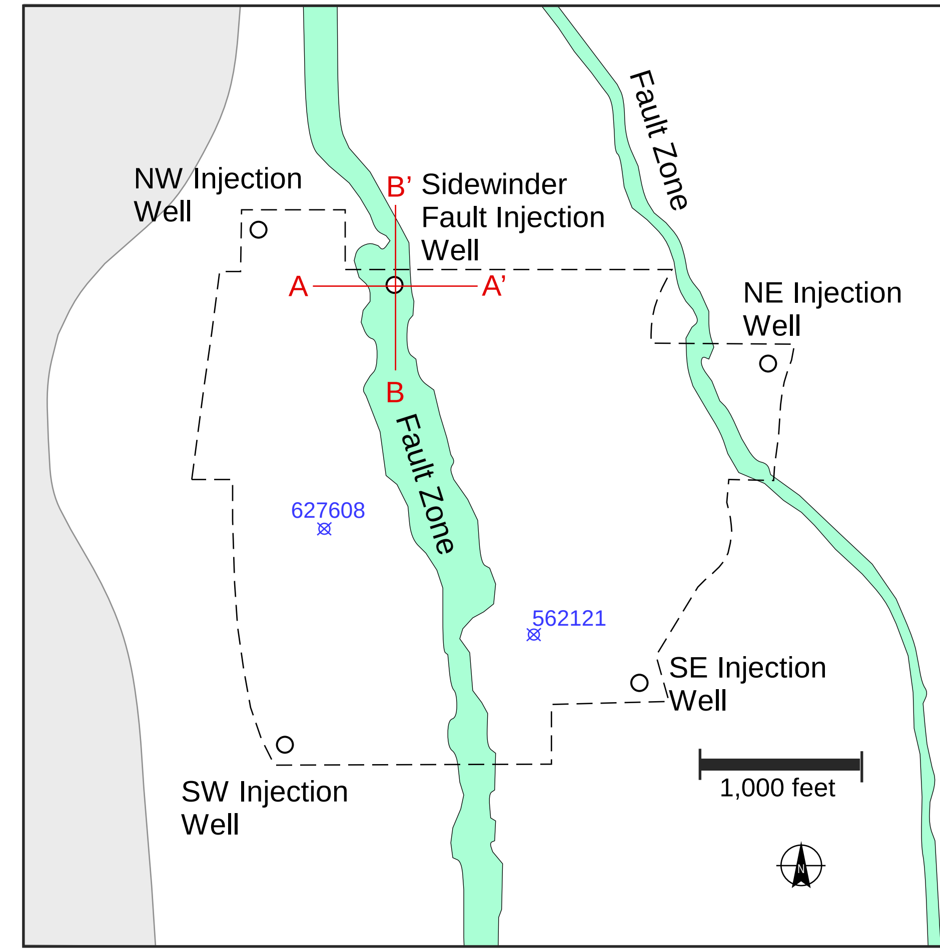
FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-12





FAULT LOCATION MAP



HALEY ALDRICH

CROSS SECTIONS
SIDEWINDER FAULT INJECTION WELL, 30 DAY INJECTION WITH NO EXTRACTION

FEBRUARY 2019
REVISED FEBRUARY 2020

FIGURE A-13

EXHIBIT A-8-2

Model Files

(Not Attached)

ATTACHMENT 2

Liner Assessment Report

Liner Assessment Report 2021

Introduction

Under Florence Copper's Aquifer Protection Permit (APP) No. P-101704, LTF 88973, Section 2.7.4.1.2 requires a liner assessment report if an Alert Level (AL) #1 has been exceeded per Section 2.6.2.2 (Normal Liner Leakage) and/or 2.6.2.3 (Liner Failure or Rips) of the APP.

This Liner Assessment Report 2021 describes the exceedance of Alert Level #1 for Normal Liner Leakage that occurred in August at Florence Copper's BHP Copper evaporation pond (BHP Pond), and includes the following information:

- Incident summary
- Results of the liner assessment
- Repairs completed, including number and location of holes identified
- Table summarizing AL exceedances including the frequency and quantity of fluid removed, and
- Corrective actions taken

Incident Summary

The BHP Pond was placed into service on July 7, 2021. The BHP Pond has an approximate dimension of 540 by 760 feet, and is constructed with 60 mil textured HDPE primary and secondary liners, with a leak detection system and a geonet between the primary and secondary liners.

On August 17, 2021 an exceedance occurred for AL #1 normal liner leakage at the BHP Pond leak collection and removal system, and the incident was reported via MyDEQ (Incident ID #12856). The incident description submitted is copied below:

After 19 hours of pumping the leak detection sump at the BHP Copper Evaporation Pond, the volume exceeded the 5,760 GPD Alert Level #1 for normal liner leakage in Table 11 of the APP. Sump pump was turned off on 8/17/2021 so that electrical resistivity testing of the liner can begin on 8/20/2021 to find any leaks. Once testing is completed, the sump pump will be turned back on, and the liner will be repaired.

Since there was not a release from the BHP Pond, and as reported via MyDEQ, there were no potential impacts to public health, no potential environmental impacts, no potentially impacted uses and no reasonable potential for an AWQS exceedance.

Flow to the BHP Pond was discontinued and a leak detection survey was conducted.

Liner Assessment

A leak detection survey was completed on the BHP Pond August 20 - 24, 2021 by HydroGeophysics, Inc. (HGI). HGI has been an industry leader in pond leak detection for over

20 years. The method used was an electrical geophysical leak detection survey that has been proven to detect small and large leaks in similarly lined holding ponds at various mines, chemical facilities, and power plants. The leak detection survey is limited to detection of leaks in the primary (top) liner in areas under water. The leak detection method is based on a fluid filled pond where temporary electrodes are installed between the primary and secondary pond liners where electrical current is transmitted. Then electrical measurements are collected within the solution above the primary liner in the main body of the pond. Electrical current can only flow into the pond via any leaks in the primary liner. Since electrical signal flows through the holes in the liner, the magnitude of the electrical signal will increase with proximity to the leak location. HGI can then locate the various leak locations by building a map of the electrical measurements over the pond.

HGI's leak detection method requires that fluid fill the entire survey area above the primary liner. Areas that are not covered with solution cannot be surveyed. Fluid must also completely fill the volume between the primary and secondary liners to the level of the liquid in the pond. Therefore, Florence Copper stopped pumping the leak detection sump.

Repairs Completed

The survey resulted in four areas of the primary liner being repaired below the water level. These four areas were located in the northwest, northeast, and southwest corners of the BHP Pond, and an area on the eastern shoreline. International Lining performed the repairs in these four areas after coffer dams were constructed, and the water was removed. As recommended by HGI, a minimum 10 foot by 10 foot patch was used at each of the four repair locations. All liner patch welds were vacuum tested for integrity, and all welds passed. The leak detection sump was put back into service on August 27, and the repairs below the water level in the BHP Pond were completed on August 31. No additional alert level exceedances of the normal liner leakage rate have occurred since the repairs were completed.

Summary Table of AL Exceedance

AL exceedances (normal liner leakage)	Liner repairs below water line	Liner repairs above water line	Quantity of fluid removed*
1	4	72	7,275 gallons on 8/17/21 (exceeded AL of 5,760 GPD)

*Table lists quantity of fluid pumped from leak detection sump on day of AL exceedance. Since liner repairs have been completed, quantity of fluid pumped from leak detection sump has ranged from a low of 350 and a high of 2,880 GPD, well below the AL.

Corrective Actions

In addition to the liner repairs made below the water level, the lined area above the water level was cleaned, and spark testing was conducted by HGI. Based on the results of the spark testing, 72 small spot patches of the liner were completed above the water level during the week of September 13th by International Lining.

ADEQ issued a “resolved” status for the incident on September 27, 2021. Leak collection and removal system monitoring after completion of the liner repairs has been below the alert level for normal liner leakage since the repairs were completed. The leakage rate will continue to be monitored according to the requirements of the APP.